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Sugar Mill Repairs in Cuba

By Fred H. Colvin
Editor, American Machinist

Where mechanical ingenuity and persistence play a greater part than the machine equipment in handling heavy repairs in record time—A 57 year old planer and its work

TUCKED away in the little town of Sagua la Grande, not far from the northern coast of Cuba and about midway of its length, is a machine shop that handles more heavy repairs in a shorter time and with less equipment than any place it has yet been my privilege to visit. It bears the title of Fundicion "Union" S. A., and as it happens, is being run by my old friend, James Macfarlane, who had charge of all the dredges in the work on the Panama Canal, where I first met him in 1911. His son, Stewart, who was just entering his teens at that time, is now his right-hand man. The shop is not much to look at, either inside or out, and the rush of the cane grinding season prevents the contemplated improvements being made before fall. But as it is, it is an excellent example of the possibilities of getting out a tremendous amount of difficult work in a limited space.

Some idea of the shop can be had from Fig. 1, the

The first article. The second will appear in an early issue.

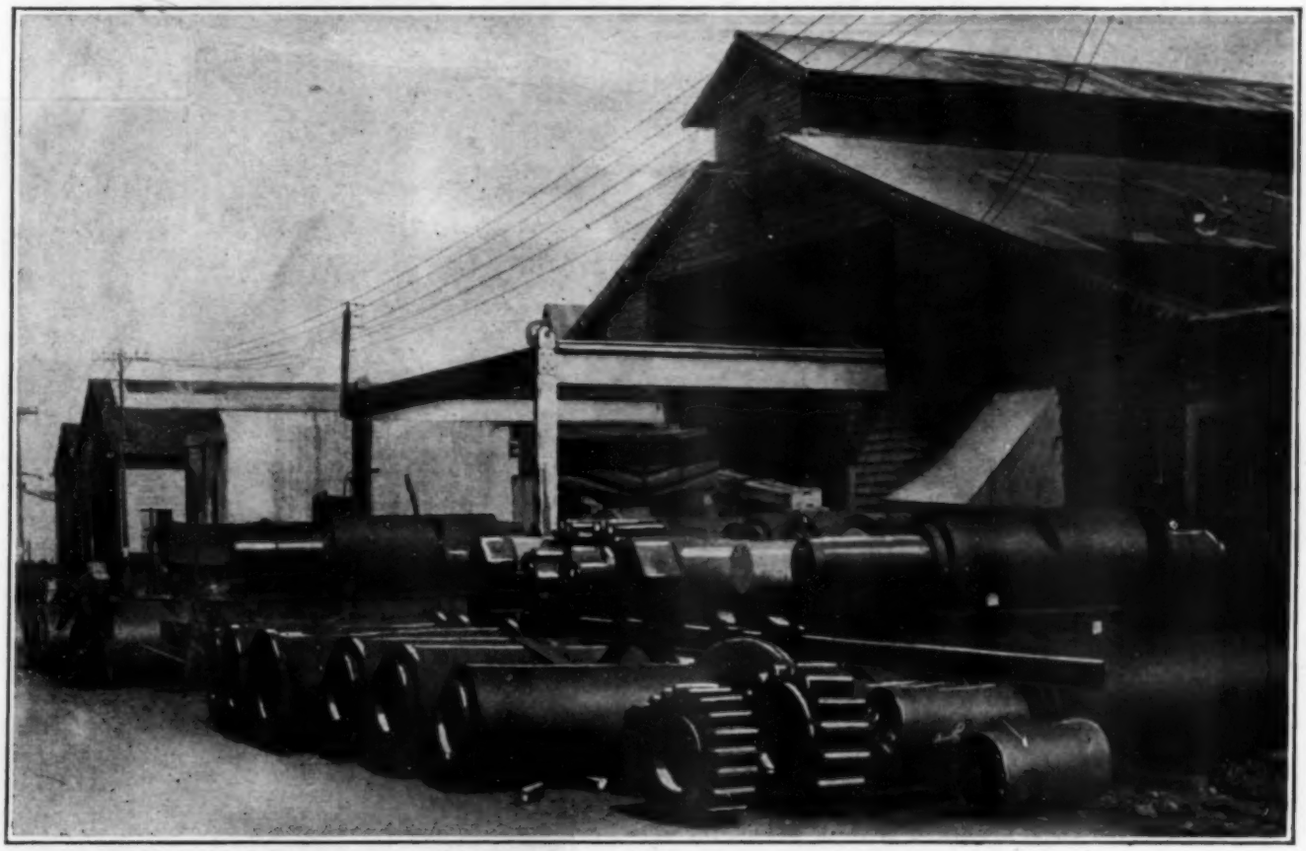


Fig. 1—The shop of Fundicion "Union"

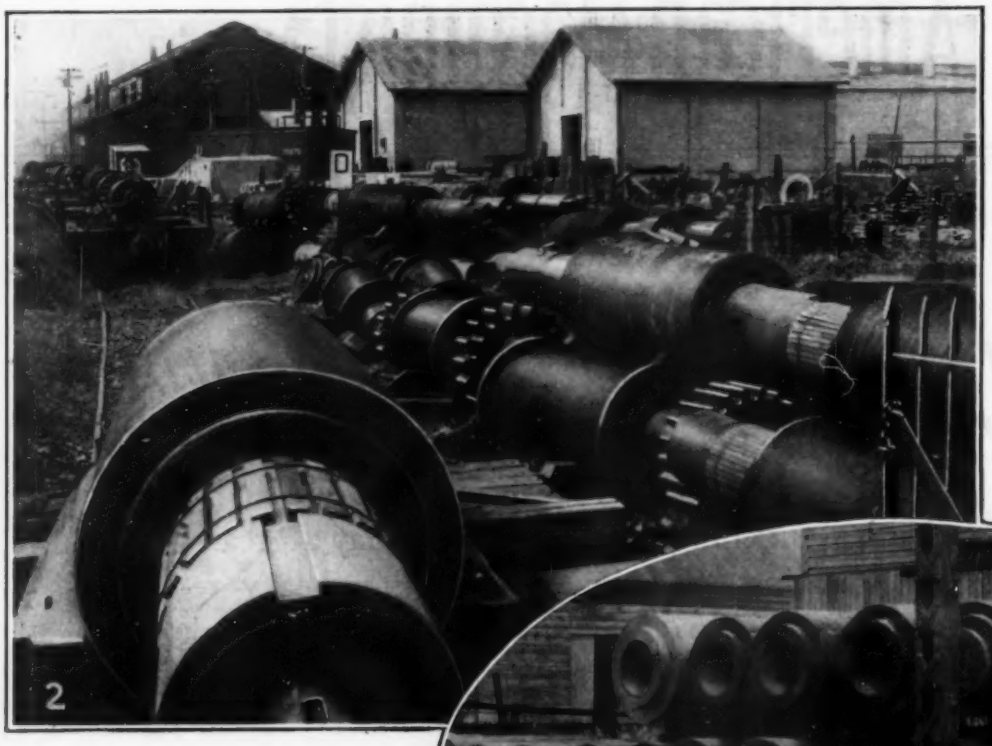


Fig. 2—Sugar rolls waiting for repair. These rolls have come from sugar mills, or "Centrals" in various parts of Cuba, some two hundred miles or more distant. The journals are protected against injury by wooden lagging. Some rolls have collars

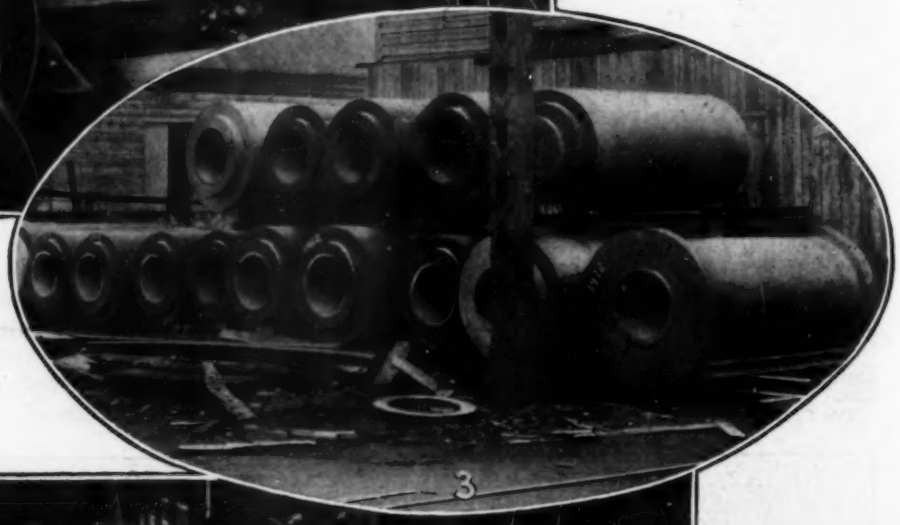


Fig. 3—Partly machined rolls waiting to be finished to suit particular requirements. They are bored and rough turned to the sizes most in demand

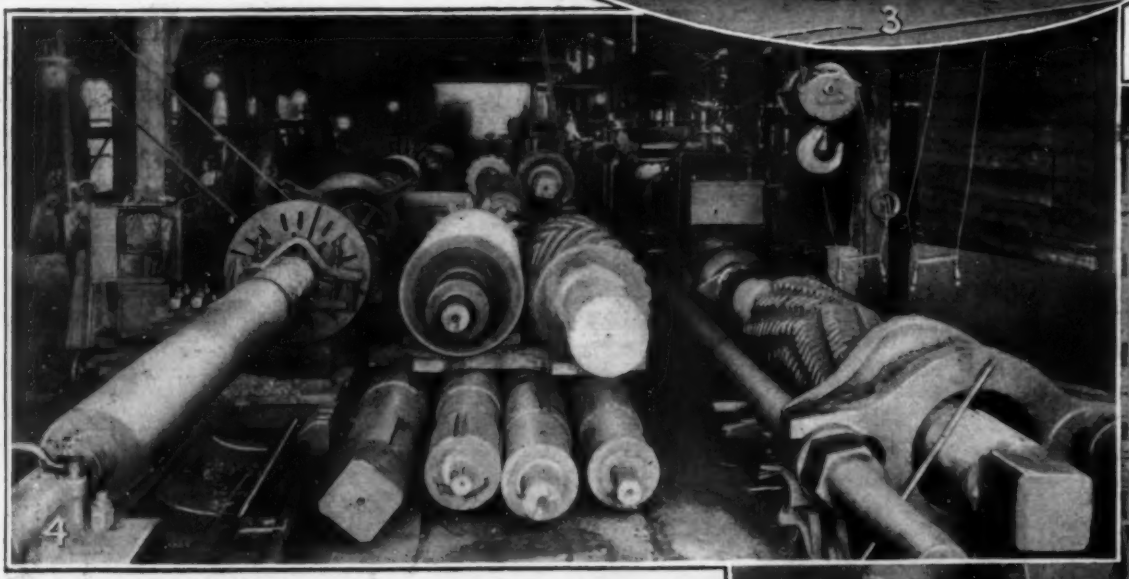


Fig. 4—Where shafts and rolls are fitted. This view shows what a repair shop looks like in the busy season. The shafts vary in design from square-end drives to shrunk-on gears

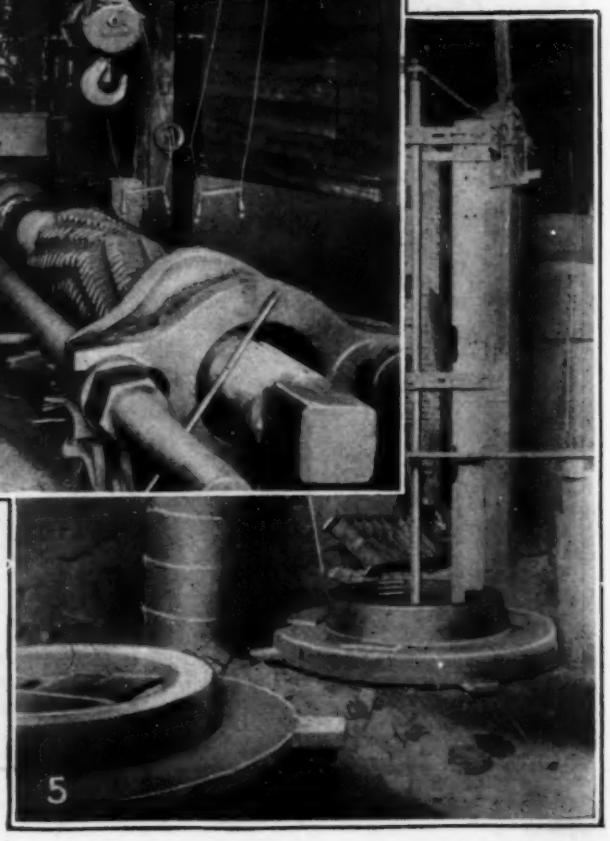


Fig. 5—Sweep for building up a mold for one of the crusher rolls. The molds are reinforced with brick and are gated at three points, the bottom, center and top

Fig. 6—Oven for baking molds and cores. The oven is built of brick and is provided with steel rails, as shown, on which the molds and cores are run from the foundry into the oven

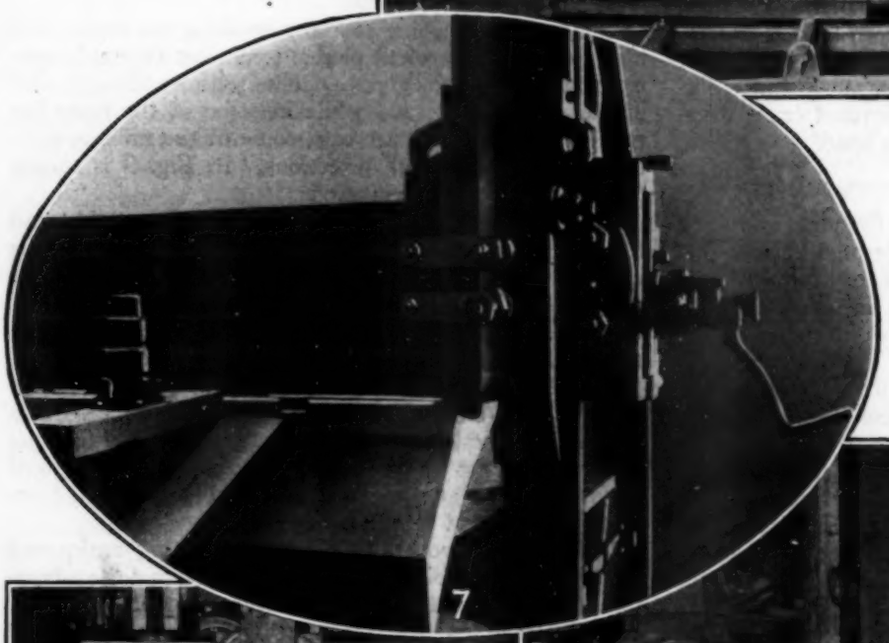


Fig. 7—Planing teeth of sugar-roll comb. The combs are held near the sugar rolls so as to scrape or comb off the small particles of "bagasse" that adheres

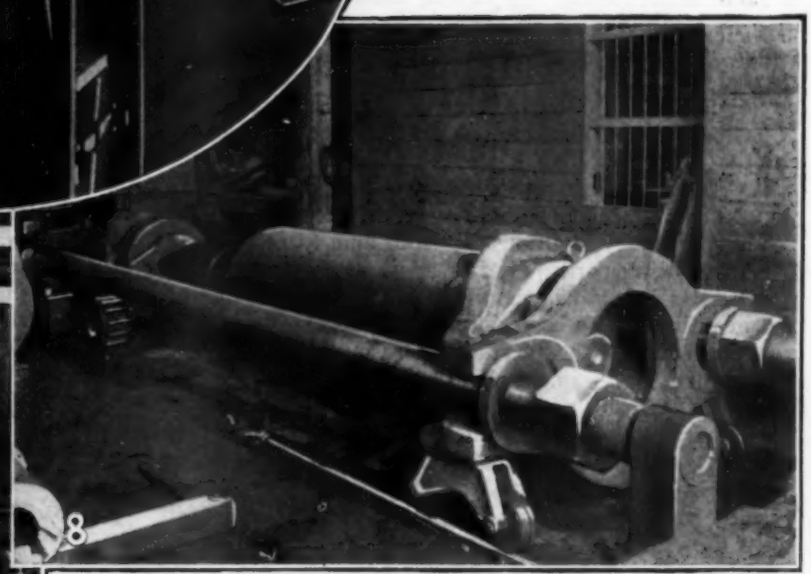


Fig. 8—Forcing a shaft into roll. A large heavy-duty press designed for this class of work. It has easily removable tie-rods and a tail cross-piece mounted on flanged rollers

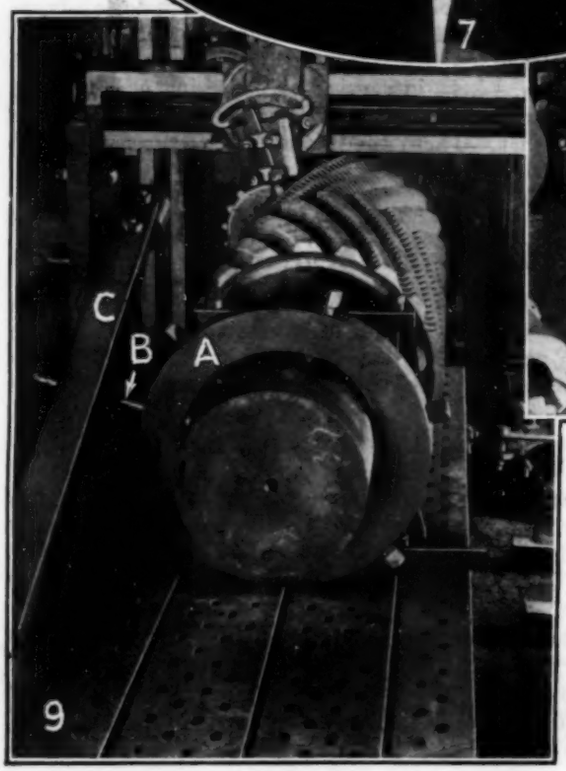


Fig. 9—Planing helical grooves in sugar rolls. The roll is mounted in bearings set up on the planer table. The large ring carries an arm that slides in the inclined guide

character of the work being clearly shown by the collection of rolls for crushing sugar cane, both mounted and unmounted, to be seen in front. Those directly under the extended craneways are on a flat car and have just arrived for repairs. Perhaps even a better idea of the way in which rolls accumulate for repairs during the dull season can be had from Fig. 2, while Fig. 3 shows some of the rolls in the rough ready to be fitted to their shafts and finished with as little delay as possible. For, during the grinding season, the one main object of all sugar mill operators is to keep the grinding rolls on the job without delays of any kind.

Stepping inside the door, one is immediately convinced that all the congestion is not on the outside, and every machine is found at work turning shafts, boring the rolls to receive them, pressing the shafts in place, grooving the rolls or otherwise getting them in condition to be shipped to the sugar mill. And on the work of this shop depends the grinding of numerous sugar mills all over this section of the island. Instead of being a local proposition, the repair work comes from long distances. Fig. 4 shows the front end of the shop, a large-shaft turning lathe at the left, a large Watson-Stillman hydraulic press at the right, the floor-operated crane overhead, and work piled in every available space.

Enormous Foundry Output

At the other end of the shop is the foundry, and some idea of the extent to which it is operated can be had from the fact that over 5,000,000 lb. of iron was cast last year. Both the molds and cores for crushing rolls are made by the sweeping process, as shown in Fig. 5. Boiler-plate retaining rings are used on the outside of the mold and bricks are used freely, with a liberal coating of sand on the inside. By casting these rolls with risers that feed the iron in at three points, the bottom, the center and near the top, a very uniform distribution is secured and the castings come clean, which is necessary on account of the fine corrugations on some of the rolls. It has been found that an open-grained iron is necessary for the best results, as it seems to grip the sugar-cane stalks and feed them through the rolls, whereas a close-grained iron glazes and does not feed nearly so well.

The rolls vary both in diameter and length, a roll 35x78 in. being perhaps a fair average. One roll of a pair carries heavy flanges which keep the plain mating roll in position, and some idea of the accuracy required may be had from the fact that there is only $\frac{1}{64}$ in. play at each end, or $\frac{1}{32}$ in. in all. Add to this the fact that both rolls carry grooves that have to match, the grooves varying from 45 to 60 deg. included angle, and it will be seen that sugar mill roll turning can hardly be classed as rough work.

Each pair of rolls has a "comb," or scraper, which keeps the crushed cane from carrying around, and which must, therefore, match the corrugations in the roll. The desired accuracy is secured by using a form tool that is very similar to a chaser, both in turning the roll and in cutting the comb.

The molds for the combs are baked in the large oven shown in Fig. 6. They are handled by a crane onto a framework made up of old steel rails and the whole frame is pushed into the oven, as shown. Heat is secured by wood fires built in the three fireboxes shown at the farther end, the firing being done through the opening shown.

The form tool used in planing one of the combs can be seen in Fig. 7, a similar tool being used in turning the grooves in the roll. These tools, or chasers, are about 2½ in. wide, and the pitch varies from 3 to the inch to about 1¼ in. between points on the coarser rolls.

The rolls are bored with portable boring bars of the Underwood type, special mountings being provided so as to make it easy to handle both the roll and the boring bar. The shaft diameters vary from about 17 to 21 in., and the usual forcing allowance is the old standby of 0.001 in. per inch of diameter, with an extra thousandth thrown in for good measure. In most cases the shafts are relieved so as not to bear the entire length. This practice naturally varies in accordance with the ideas of the designer of the rolls, and it was formerly customary to use keys in addition to the force fit. Some of the keyways can be seen in the shaft in the center of Fig. 4. The average pressures required for forcing the rolls on the shafts are about 850 tons for a 17-in. shaft in a roll 6 ft. long, and 1,100 tons for a roll having a 21-in. shaft and 7 ft. long. In Fig. 8 is a close-up of the operation of forcing a shaft in a roll.

Some of the crushing rolls for breaking the sugar cane into comparatively small pieces, somewhat resemble herringbone gears, as in Fig. 4. These rolls are also grooved in the regular way, and while in some of the roughing rolls the corrugations are cast, some of the mills require them to be cut in both directions. In Fig. 9 is shown the cutting of the corrugations.

The roll is mounted in bearings on the planer table, and the collar *A* which carries the arm *B* is fastened on the end of the shaft. The inclined guide *C* controls the movement of the arm *B*, and with it the roll being planed. And in spite of the rolls being for comparatively rough work, the angles of the helix must be fairly accurate, since there are two rolls meshing together and the teeth are separated only a comparatively short distance. This planer, incidentally, is an old Sellers and bears the serial number 285, and was built 57 years ago. It last changed hands 22 years ago and is still carrying loads of from 14 to 18 tons, and frequently runs 16 hr. per day.

This case, however, is not one of using antiquated machines from choice, but from necessity, and the advantages of new machinery are fully appreciated. In one case, a large engine lathe with an internally geared faceplate was kept in service by shrinking a steel band around the outside of the faceplate in order to hold the gear together. These conditions, however, are likely to be changed in the not very distant future.

An Improvement in Ladle Design

For many years it has been the practice in the iron and steel industry to transport molten metal from one location or furnace to another in open ladles. Recently a closed-type ladle has been introduced that has a shape similar to that of a submarine and is mounted on trucks of standard railway construction. The only opening in this ladle is one at the top about 3 ft. in diameter, so that the heat loss from the free surface is much less than from an open-type ladle. These closed ladles are made in capacities up to 150 tons of metal.

The Bureau of Standards recently conducted a test for the American Foundrymen's Association to determine the rate of cooling and the heat losses from such a 75-ton closed car ladle. It was found that the molten iron cooled only about 6 deg. C. (11 deg. F.) per hour, and with this rate of cooling it would be possible to hold a ladle of molten iron for forty hours before pouring.

Portable Electric Tools for High-Frequency Current

By C. B. COATES
Electrical Engineer, Chicago Pneumatic Tool Co.

Speed of the induction motors used is 10,800 at no load and approximately 9,900 at full load—Either motor-generator set or frequency changer used to produce current

IN THE high-frequency, portable, electric tools that have been in use for the last two years or longer, the three-phase a.c. induction motor is employed. The frequency of the usual a.c. is increased from 60 to 180 cycles per second, thus increasing the synchronous speed of the motor at no load to 10,800 r.p.m. and the full-load speed, assuming 8 per cent slip, to 9,936 r.p.m. The result is great increase in power without any increase in the size of the rotor.

High-frequency motors are now used in portable tools for drilling, reaming, tapping, driving screws, running nuts, grinding, buffing and sanding.

The principles back of the high-frequency induction-motor tool are not difficult to understand. It is well known that the squirrel-cage induction motor requires only slight attention, due, largely, to the absence of commutator and brushes, and to the fact that the secondary element, usually the rotor, cannot be burned out.

Low Rotor Speed

Their principal drawback in portable tools has been that on the standard power lines where a frequency of 60 cycles per second is available, the rotor speed is so low, as compared to commercial electric tools, as to make the weight prohibitive. The power developed under load by any portable tool with a given size of armature or rotor (assuming that the best proportions and windings have been used) depends upon the speed under load, and is in almost direct proportion to that speed.

Assume that a certain direct current or universal electric drill has an armature speed at no load of 11,000 and a full load speed of 4,800. If, by any means, the full-load speed could be increased to 9,600, the power of the tool would be doubled. The limiting speed of a d.c. or a universal motor is, of course, the free speed and, in the case of a large tool, it would not be increased to the extent required to give a loaded speed of 9,600. If we were to apply 60-cycle, 3-phase, two-pole windings to this same tool, we would have a free or synchronous speed of 3,600, and a loaded speed of say 3,300 (with about 8 per cent slip). This is even lower than the d.c. or universal motor under load and would mean the development of less power.

The polyphase a.c. induction motor has the advantage of less drop in speed (slip) under load in addition to its mechanical advantages. Inasmuch as the speed of such a motor is a direct function of the frequency, it is evident that by increasing the frequency the lack of speed and power can be corrected and a marked improvement made in the speed characteristics of the tool. When 3-phase, two-pole windings are applied to adapt this motor to a frequency of 180 cycles per second, the synchronous speed at no load will be three times as high as at 60 cycles per second, or 10,800 as compared with 11,000 on the d.c. or universal. The full-load speed, with 8 per cent slip, will be 9,936 or more than double the 4,800 of the other motor. It will readily be seen that with the same size motor the power is more than doubled with no increase in free speed.

It is along these lines that the new high-frequency tool has been developed. The selection of the best frequency was a matter of great importance, and 180 cycles per second was chosen as providing the most satisfactory speed for ball bearings used in portable tools and as providing greater margin of overload than found in the existing types of tools. It is also a multiple of 60 cycles and can be easily produced by motor generator or frequency changer. It will be quite evident that to build tools of this character it has been necessary to provide the greater gear reduction required by the higher loaded speed at the rotor.

A tool that lends itself particularly well to the high-frequency motor is the portable grinder. The free speed is limited by the peripheral speed of the grinding wheel, and the high-frequency tool, with its close speed regulation, operates at the proper cutting speed, well within the safe no-load speed.

Constant Speed and Power

High-frequency tools operated according to the principles described have several attractive characteristics: On account of their high speed under load they deliver increased power without increase in weight. Their speed is practically constant. Maintenance cost is low because of the absence of commutator and brushes and because the squirrel cage rotor cannot be burned out. Due to the low free speed the ball bearings have long life. Drill bits and reamers, because of the constant speed, are not subject to frequent breakage. There is a similar effect on the life of abrasive wheels and sanding disks.

This system of high-frequency tools calls for special current-generating apparatus and independent wiring. One advantage of the separate wiring is that it is relatively simple to maintain lines free from grounds. In

addition, most high-frequency tools are provided with a ground wire.

For high-frequency tools manufactured by the Chicago Pneumatic Tool Co., under the trademark "Hicycle," a special motor-generator or frequency changer is required to produce the current. The motors operate on 180-cycle, 230-volt, 3-phase current. Transforming is quite simple. The motor generator set consists of two units, a motor and a generator, either coupled together and on a common base-plate or the two units incorporated on one shaft with two ball bearings. The motor of this set can be wound to operate on any kind of electric current, d.c. or a.c., and drives the generator through the medium of its shaft. The generator is usually provided with stationary fields that are excited from d.c. source. Assuming the speed to be 1,800, a 12-pole generator will furnish current at 180 cycles at the three collector rings on the armature. If this were driven by a 60-cycle induction or synchronous motor, the motor would, of course, have 4 poles and a d.c. exciter would have to be provided to furnish current for the field of the generator.

It is possible to build the generator with revolving fields, in which case the direct current would enter through two collector rings and the 180-cycle current would be taken from the stationary stator winding. With the motor-generator set, voltage control can be obtained by varying the exciting current in the field of the generator.

One other method of producing high-frequency current involves the use of a frequency changer. It can be operated only from an a.c. source and no d.c. is involved, thus eliminating the exciter. If a three-phase slip-ring induction motor has its rotor blocked so that it cannot revolve, the 60-cycle current is applied to the stator, a transformer effect will result and 60-cycle current can be taken from the slip rings. Assume this to be an eight-pole motor with a normal speed of 900. Now, if the rotor is driven by a motor, or otherwise, in direction opposite to that in which it would run as a motor, an additional frequency of 60 cycles per second will be produced so that 120 cycles will be supplied from the collector rings. If the speed be increased to 1,800, or double speed, 120 cycles will be added to the 60 of the line and give 180. The size of the motor required to drive this outfit will be 120/180 or $\frac{2}{3}$ of the entire input required for the generator, as $\frac{1}{3}$ of the power is coming directly from the supply line into the stator. The only saving effected is, of course, in the first cost of the motor.

This frequency changer is being very successfully used, it being necessary, however, to design it for fairly close voltage regulation (not greater than 8 per cent), and it is not possible to vary the voltage.

Getting Help from the Operator

By John Homewood

WHILE the machine operator knows nothing about the ins and outs of the trade, he knows the machine which he has been running for some period of time. In fact he knows the machine better than the mechanic does. If the mechanic, who is assigned to a certain machine that is not functioning properly, will meet the operator with an open mind, he can secure far more satisfaction than if he goes at the job without. I have found that by treating the operators with respect and giving consideration to their suggestions, the path of difficulty is made straighter and easier to travel.

"Old Man Overhead" in the Machine Tool Industry

By George H. Corliss

Advertising Manager, S. A. Woods Machine Co.

DURING the war period when business of every kind boomed and competition lost its keen edge, the market was dominated by the seller rather than by the buyer, and the enterprise, the initiative, the aggressiveness of business men, as a whole, suffered severely. But, of course, that is all changed now. Post-war conditions have re-established the old-time competitive era that calls for the constant exercise of watchfulness and intelligence on the part of every business man who expects to keep away from red ink figures.

Immediately following the war, concerns that had built up large plants felt that it was necessary to go after volume business in order to overcome their overhead costs, and the country generally passed through a volume-craze during which sales totals seemed to be more important than net profits. That stage also is passing.

That these developments are generally recognized is shown by the way in which the water is being squeezed out of the various industries, costs are being more closely scrutinized than ever, the performance of the individual employee is being compared very closely with his compensation, and, if he cannot make good, he becomes automatically eliminated. All of this is resulting in the discovery that in many business vehicles there are "fifth wheels"—surplus employees on the payroll, too much help taking things easy, too many people doing the work, and not enough attention being paid to the fact that all these things make it impossible for a business to show a profit.

What is true of the human element in business is equally true of the mechanical element. Investigation is showing that in many plants obsolete, worn-out machines are being employed to do the work that would be done quicker and better by more modern machines.

Naturally, the plants that are viewing these things solely with the idea of getting at the facts so as to be able to act promptly and with intelligence, are getting a competitive advantage over the concerns that are still trying to do business on the basis of the years preceding 1914. They have curtailed the expensive organizations that were built up during the war, they have reduced the overhead that has been making it impossible to show a profit, they have cut everything down to the bone, and at the same time have taken care that their productive facilities have been thoroughly modernized with the result that they are not lacking for orders and they are making a profit on the business they are doing.

Today, the sharp-eyed managers of businesses, having found out that the law of diminishing returns is in full operation, and that volume business in itself is a detriment unless it shows a profit, are deliberately shrinking their activities, trimming their sales to suit the direction in which the business winds are blowing, paying equally close attention to the production and to internal management, eliminating every employee who can be spared, junking the machinery that cannot show a profit, and installing the equipment and the methods that will give the business a chance to make good.

Most emphatically is it true today, as it always has been true, that business is to be secured by the concerns who are willing to go after it with the intelligent determination that commands success.

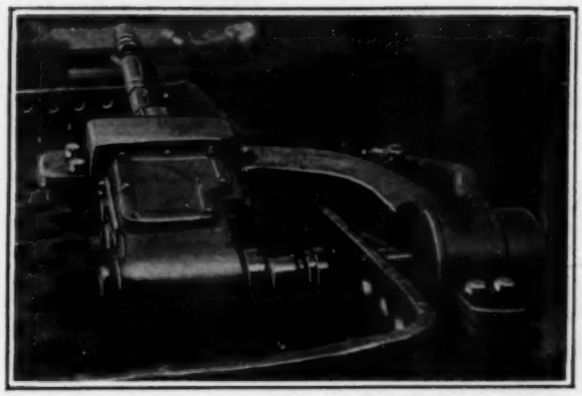


Fig. 1—Countersinking flange holes in a flue sheet

Special Tools in a Railroad Shop

By FRANK W. CURTIS
Western Editor, American Machinist

HOME-MADE tools at the Southern Pacific shops, Houston, Texas, play an important part in locomotive and car maintenance. Rivet holes in flue-sheet flanges are countersunk from the inside by the close-quartered air motor, equipped with an "old man," illustrated in Fig. 1. A 3-in. air cylinder, connected to the "old man" has a plunger that draws the countersink into the flue sheet when the motor is in operation. The cylinder is piped to the motor end of the air line so that it functions in unison with the motor. A helical spring, mounted within the cylinder, pushes in the plunger when air is cut off from the motor, allowing the device to be shifted to the next hole. Pistons and piston rods are assembled in a hydraulic press as illustrated in Fig. 2. The piston end of the assembly is supported by the piston-rod resting on an adjustable anvil block. The opposite end bears against the ram of the hydraulic press. The anvil block, mounted on rollers, is guided by ways. Key slots suitably positioned in the ways, permit the block to be locked in any desired position. This feature permits adjustments for assemblies of different lengths. Constructional details of the machine are illustrated in Fig. 3. The hydraulic head is part of an obsolete crankpin press, and is mounted on two I-beams that form the base of the machine. In the upper right-hand corner is a table of pressures applied in assembling rods of different diameters. A gage attached to the hydraulic head registers the pressure. Prior to the construction of the machine pistons were drawn in place by the nut, but no check could be made of the pressure applied, and it could not be told whether or not the joint was solid. Work requiring taper turning is handled in a lathe equipped with the taper attachment illustrated in Fig. 4. A bracket, supporting the slide of the attachment, is fastened to a longitudinal plate attached to the lathe bed, so that the bracket can be moved and locked in different positions to suit the work. A leg, having a caster at its lower end, is attached to the bracket to support it.

In Fig. 5 is illustrated a water-glass grinder that accommodates two glasses at once setting. The grinding is accomplished by placing the glasses in holders so that their faces rest on a revolving disk to which grinding compound is applied. The glasses are held by flat springs

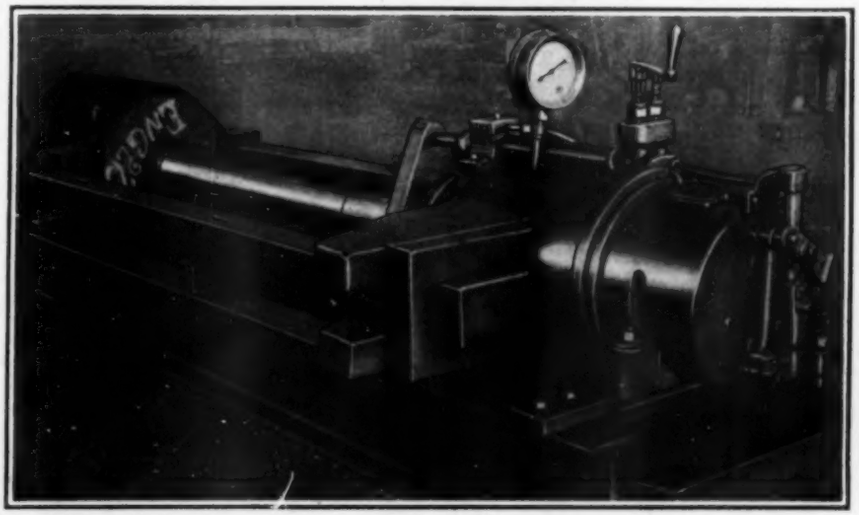


Fig. 2—Assembling a piston and a piston rod

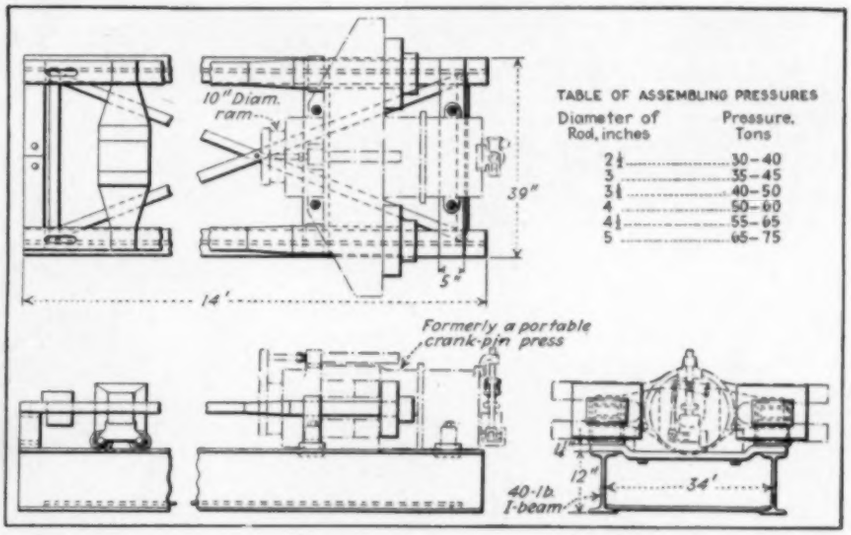
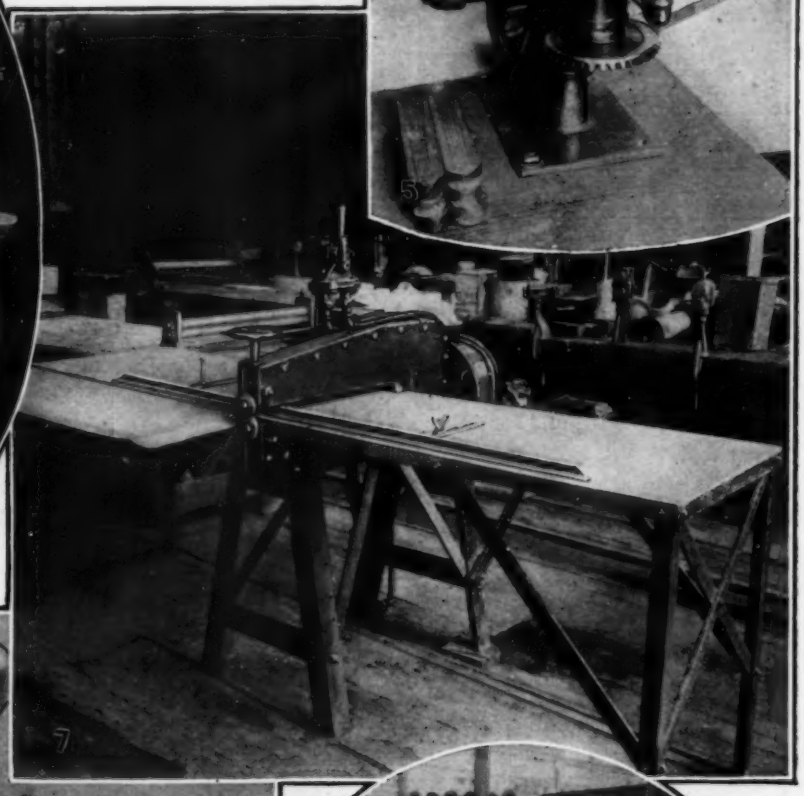
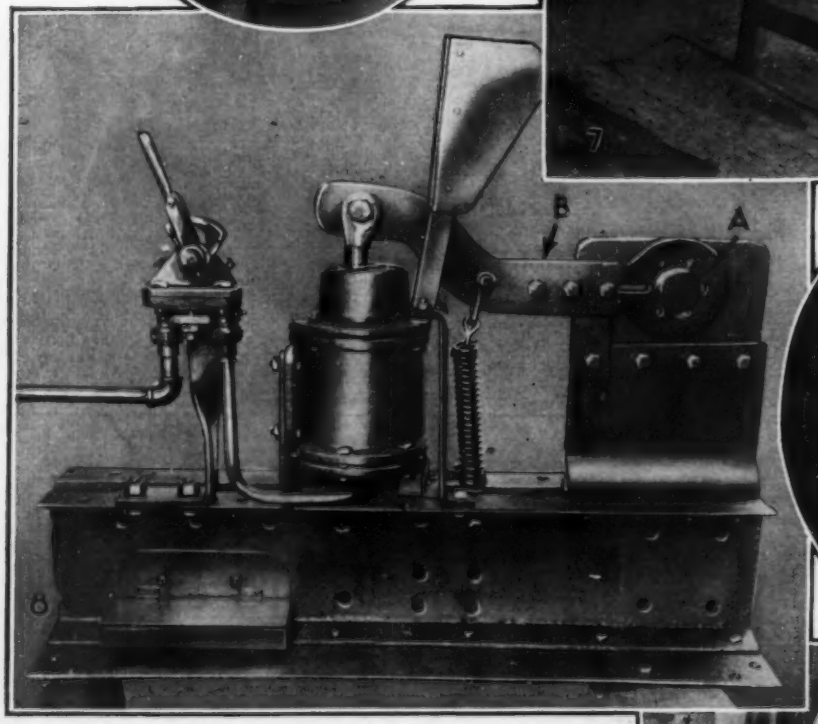
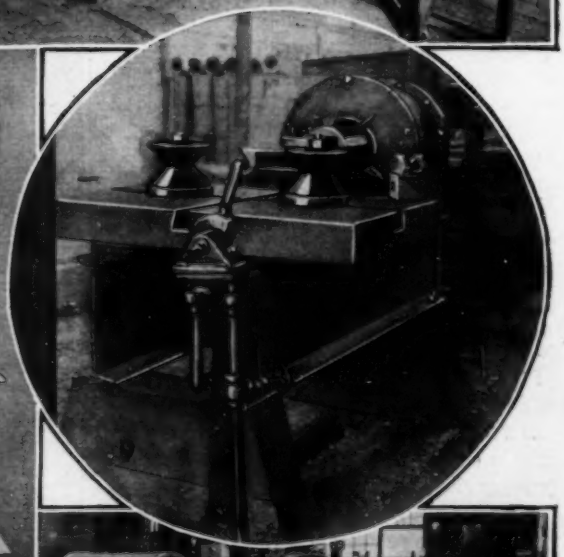


Fig. 3—Constructional details of the assembling press

Fig. 4—Taper-turning attachment fitted to an engine lathe







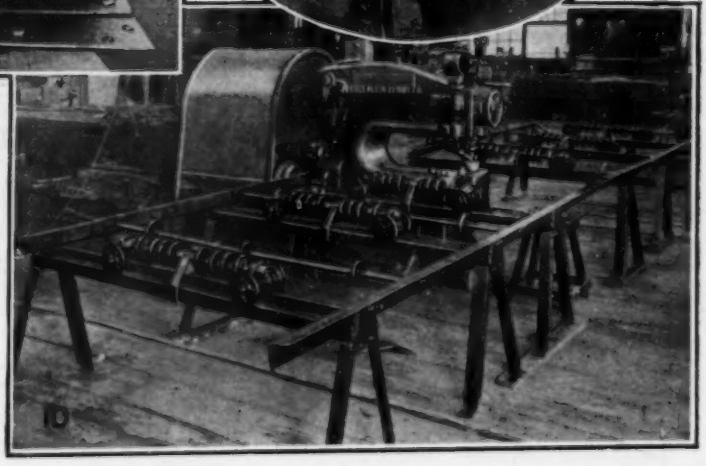


Fig. 5—Grinding device for water glasses. Fig. 7—Air-operated shear for sheet-metal work. Fig. 8—Device for shearing rivets. Fig. 9—An air-operated pipe-bending machine. Fig. 10—Table support for handling plate work to be punched

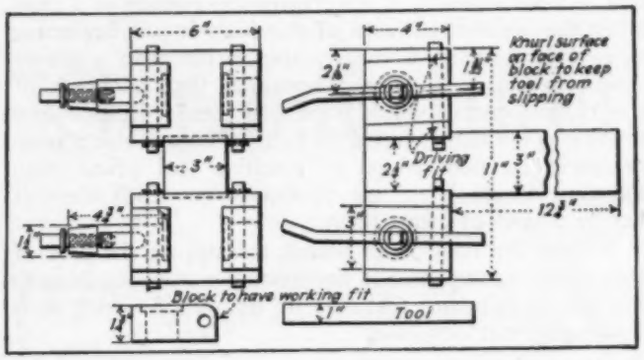


Fig. 6—Combination tool for planing crosshead gibs

connected to an overhead bar. The bar is pivoted at one end and is held in place at the opposite end by a finger lock. To remove the work, the bar is released and swung back.

A crosshead-gib planing tool, with four tool posts, is illustrated in Fig. 6. By setting the tools to proper widths and at relative heights, the work is rough and finish planed in one setting, utilizing the forward stroke for roughing and the return stroke for finishing.

Sheet-metal parts used in connection with car repairs are cut to size in the roll shear illustrated in Fig. 7. The machine is driven by an air motor, through gearing, located at the rear of the table. An adjustable angle guide mounted on the table determines the width of the piece cut.

Rivets of standard length are sometimes too long for use in connection with certain assemblies and it is necessary to cut off their ends. The shearing is accomplished in the device illustrated in Fig. 8. It consists of a stationary and a revolving shear plate *A* having a series of holes in proper relation to each other to accommodate rivets of different diameter. The shear plate is operated by the piston of an 8-in. air cylinder having a ball joint at the piston end to compensate for the arc of travel of the arm *B*. The rivet to be sheared is placed in one of the holes of the shear to a predetermiend depth. Admitting air to the cylinder causes the piston to rise and, through the arm *B*, to revolve the movable shear plate, thus cutting off the rivet.

Fig. 11—A welding table having a fire-brick top

Another air-operated device of value is the pipe bender illustrated in Fig. 9. The unit comprises a 14-in. air cylinder, to the piston of which a forming head is attached. Two cylindrical, V-shaped supports are located on the table as shown. Their position is adjustable to suit the radius to which the pipe is to be bent. The pipe is placed between the supports and the forming head. Admitting air to the cylinder causes the forming head to contact with the pipe and bend it.

Miscellaneous car plates are punched in a standard punch around which is located a built-up table having a number of rolls mounted thereon to facilitate handling. The unit is illustrated in Fig. 10. Six carriages carrying rollers, and equipped to roll on crosswise members of the table, permit plates to be easily moved longitudinally and transversely. The table is made of angle-iron framework, and the rolls are made of flue-sheet cuttings. In the same department is located a table utilized for miscellaneous welding operations. The top of the table, illustrated in Fig. 11, is constructed of fire brick, and the frame is made of boiler plate. Racks at the end hold the welding rods convenient to the operator.

Co-operative Apprenticeship for High School Boys

By Ruth Bartlett
Instructor, Fremont High School, Los Angeles

A SYSTEM of co-operative machine shop instruction for high school boys has been successfully worked out in the John C. Fremont High School, Los Angeles, Calif. The Fremont High School has an enrollment of more than 2,000 students, and is located in an industrial section of the city. The majority of students attending are taking vocational courses, with a view to entering similar work as soon as they leave school, many of them being unable to remain for the full four-year course.

The school has an unusually good shop equipment, with one shop devoted entirely to machine trades, and the other having courses in printing and the several woodworking trades. During the past year ten companies in the city have been co-operating with the school. The boys spend alternate weeks in the school and in the employ of the companies. During the alternate weeks spent in school, the boys receive six hours of instruction a day, two of which consist of machine and automobile shop instruction, with discussion of the particular problems of their outside employment. Modifications of the regular co-operative plan have been made to meet special needs. For example, by an arrangement with one company, the apprentices assigned from the high school spend a half day in school and a half day in the company's plant. In another case, 67 apprentices from one of the railway companies were entered in the high school co-operative course, whereby they received four hours a week of school instruction.

The Fremont High School does not claim originality for the idea, but it has succeeded in developing the plan to meet the specific needs of its own community. It is likely that eventually the co-operative method will be extended to other occupations for which the high school students are preparing themselves. The co-operative shop classes continue during the summer, as well as during the regular school year. It has been found that when a boy is finally obliged to leave school to become a regular wage earner, the transition is an easy one, since he may continue with the company with which he has worked.

Book Reviews

FOREMANSHIP. By Glenn L. Gardiner. Six hundred eighty pages, 6x8½ in., heavy cloth boards. Indexed. Published by A. W. Shaw Co., New York. Price $6.

THIS timely and comprehensive volume constitutes a real manual for foremen, or for those with aspirations to become foremen. It is estimated that there are 900,000 foremen in the United States, and that forty million workers, or one third of the population of this country, are directly affected by the type of foremen in industry. According to the author of this book the livelihood, happiness, and satisfaction of this great group depends largely upon foremen, and in the book he has analyzed the foreman's job with the idea of giving the foreman a text that will be of service in carrying out well the duties of this important position.

The volume is divided into six books containing thirty chapters in all. The material is well arranged in groups and sub-groups, and for easy reading and reference subtitles are frequently used in the chapters. The whole is carefully cross-indexed so that the foreman can use it as a handbook on the principles of foremanship. The first book on "The Foreman" takes up the newer ideas relating to the foreman's position, and makes an analysis of his functions and qualifications. The foreman's job and duties are covered in the next two books, discussing methods of fitting himself and his men to the work. The fourth book, on the development of foremen, takes up the subjects of the training needed for effective work, and the best procedures for foremen's clubs. The final chapters go into detail on such subjects as: Planning daily duties, handling men, wages, incentives, and the economics of the entire plant such as costs and overhead in their relation to the foreman. The volume is not one that will be lightly read and cast aside, but rather a handbook that will be placed alongside the foreman's mechanical handbooks for constant reference.

YOUR MONEY'S WORTH. By Stuart Chase and F. J. Schlink. Two hundred eighty-five pages, 5x7½ in. Cloth boards. Published by The McMillan Company, New York City. Price $2.

THIS book is distinctly worth reading. Although it is devoted to showing how the consumer is being fooled by over-advertised, under-quality goods, and how he may protect himself by purchasing commodities to standard specifications, it has a message for industrial buyers as well. Many of them are just about as lax as the average consumer in checking the quality of their purchases and are therefore being victimized.

The authors are careful to state in more than one part of their book that the practices they condemn are those of the unscrupulous minority and not those of the great majority of honestly conducted businesses but they point out the crooked dealings of so many well known companies that the reader, unless he is careful to keep his perspective, is likely to get the impression that honesty is the exception rather than the rule. He is also in danger of gaining the idea that advertising is primarily a tool of high pressure selling and as such should always be viewed with suspicion.

The support given the earlier procedure of the Federal Trade Commission is unfortunate, coming at a time when the present chairman of that body is just beginning to give to its work a constructive rather than a purely destructive aspect. The assumption that adoption of the metric system would facilitate standardization and lower costs is hardly based on fact. There is also a most unconvincing comparison of machine tool prices with those of automobiles, two products for which there is hardly a basis of comparison.

Withal, the book is an honest attempt on the part of two scientists to persuade the consumer to call science to his aid in reducing the cost of living. As such it is thoroughly commendable.

MANUAL OF THE ENDURANCE OF METALS UNDER REPEATED STRESS. By H. F. Moore, Research Professor of Engineering Materials, University of Illinois. Sixty-four pages, 5x7 in. Illustrated with photographs, drawings, charts and tables. Engineering Foundation Publication No. 13. Published by the Foundation, 29 West 39th St., New York, N. Y. Price $1.

THIS booklet contains in condensed form a summary of the various investigations made in the fatigue of metals under repeated stress. The first chapter is largely historical, while the second discusses testing machines and dimensions of specimen. The characteristic stress-cycle diagram is then explained and, in conjunction, a table of endurance limits shows for various metals the limiting load below which the life is practically infinite and above which the life is relatively short. Stress-concentration factors are also studied, followed by a brief resumé of typical fatigue failures in service.

A list of definitions of terms is included as well as tabulated library references. The information is presented in usable form for designing, inspecting, testing and operating engineers.

THE ENGINEERING INDEX 1926. Eight hundred and nine pages, 6x9 in., cloth-board cover, indexed. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y. Price to members $6, to non-members $7.

THIS volume consists of an index to articles on mechanical engineering and the more closely related subjects including chemical, civil, mining and metallurgical, and electrical engineering. The present volume covers, as far as possible, the year 1926. However, its users will find that it contains references to many 1925 periodicals which were received too late for inclusion in the volume for that year. Publications for 1926 that were received after copy was closed for this volume will be indexed in the 1927 book. The Engineering Index is an extension of the service rendered by *Mechanical Engineering*, the organ of the American Society of Mechanical Engineers, to its readers; but in addition to the references published monthly during 1926 in *Mechanical Engineering*, this volume contains an even larger number of references obtained from other sources. A list of the periodicals indexed is included. Each item is completely cross-indexed. The engineering Index gives the technical man means of access to the latest engineering thought.

The Engineering Societies' Library rendered a service to the purchasers of the Engineering Index which consists of furnishing, for a nominal charge, photostatic copies and translations of the articles listed.

German Industry Tomorrow

By EDWARD J. MEHREN
Vice-President, the McGraw-Hill Publishing Company, Inc.

IN THE preceding article, published on page 177, Vol. 67, the general conditions in Germany today were described.

What, now, of the future?

Though not formulated in one place, there is a definite program in hand in Germany, a program that is obvious, one might declare, because it is forced, by necessity, but a program, nevertheless, that deserves recognition and study. The crux of the situation is the need for export trade, and, secondly, for an export trade balance. For the first, Germany must make goods that other countries either cannot or do not make, or do not make of equal quality; or, for equal quality, she must make goods cheaper. Other countries must need some German products so badly that they will take the goods over their own tariff walls; and, in turn, Germany must manufacture other goods so well and cheaply that the goods can leap the barriers. Secondly, imports must be reduced, relatively at least; Germany must produce and manufacture as much as she possibly can at home. Here are two examples of steps taken to increase export trade; they are not the most important, it is true, but they are characteristic of the energy being displayed.

Two things are necessary to assure the success of the rehabilitation program in Germany—export trade and an export trade balance. Present effort is being concentrated on these two factors in the rebuilding of a once powerful commercial structure

German commercial shipping (which enables Germany to sell service, and therefore represents an "invisible" export) has been built up to over 3,000,000 tons, compared to the 320,000 tons to which it was reduced under the Versailles Treaty. It is worth noting that the tonnage in 1913 was about 5,000,000.

Second, Germany has taken the world's leadership in commercial airplane building and commercial air-service. This accomplishment will help increase export trade, through the sale of planes, a high-cost product, and also of service, the latter in the form of airplane routes. The extent of this development can be realized from these figures: In 1926, all the large cities of Germany and some small ones (50 in all) were connected by daily air service, the number of passengers carried was 56,000, the number of miles flown daily, 25,000 (40,000 km.). Remember, too, that Germany has an area about equal to that of Texas, and that all plane building was forbidden for a number of years following the war.

In the matter of becoming more nearly self-supporting the chemical industry shows striking examples. Germany is now independent of Chile for saltpeter. In fact, she is exporting nitrogen fertilizer made from the air. It is expected that the production of nitrogen this year will reach 600,000 tons, of which 90 per cent will be synthetic. This is of immense importance to Germany. It cuts down imports (of Chile saltpeter), it gives a new commodity for export, and it offers the German farmer, through cheap fertilizer, a means of increasing crops, thus again cutting down imports (of foodsstuffs). Incidentally, Germany is now exporting complete fertilizers (containing nitrogen, phosphoric acid and potash) of very high concentration—64 per cent plant food. These are expected to have a large market in competition with the usual fertilizers of low plant food content. The nitrogen and potash are secured in Germany and rumor has it that an electric process just going into production will permit the use of Germany's low-grade phosphorous supplies, thus, if it should prove true, making the importation of phosphorous also unnecessary. A second marvelous chemical development is the distillation, or as it is here called the "liquefaction" of coal. This process produces motor spirit, lubricating oil and other products. A large plant which, by the way, will use lignite and not bituminous coal is now being built by the I. G. on the economic ground of being able to undersell gasoline made from petroleum. In a few years, this process is expected to make Germany independent of petroleum supplies—again a reduction of imports. Incidentally, the world scramble for oil drops into the realm of history if the expectations regarding coal liquefaction are realized. That they will be realized is hardly questionable. Germany has been a leader in the chemical industry too long for the I.G. to make a false move in spending millions on a new plant.

Without a doubt German science and engineering will go forward in helping industry in other lines, as they are in chemistry, to produce new and superior products with which to develop foreign markets or reduce importation into Germany.

Going along side by side with the type of efforts described there is a drive for cost reduction in industry that is intense and inspiring. It constitutes a friendly challenge to the scientific and engineering genius of other lands. The details are of such interest that they have been in part expanded in a separate article on industrial rationalization shortly to be published in this paper. A short résumé, so that the present series of two articles may be fairly complete, is desirable.

Heading all cost reduction efforts is the solid German front of scientific and industrial research which has been renowned for more than a generation. Suffice it to

say, that its intensity and breadth have been increased under the economic urge pressing on the country. To be noted especially is the attention being given to what might be called research in pure science—the effort to explore new areas and to conquer new realms in the domain of science. Mr. Hoover has repeatedly emphasized the need for such research, in addition to research directed at immediate practical ends. Here in Germany research in pure science is in full blossom, not only in university laboratories, but within factory walls. For example, in one chemical plant I visited, employing 15,000 men, there are 300 people in the laboratory, and of these, 100 are engaged in research in pure science. These 100 have no concern with the technical problems of the plant, nor necessarily with new products. Their duty is to explore and to push out far beyond the practicalities of the day. It is for the management to have faith that some day and in some way the bread thus cast upon the waters will come back. Be it remarked, too, that such confidence in the past has not been disappointed.

Rationalization Dominates

The great drive for industrial cost reduction comes under the head of rationalization—one of the dominant topics in Germany today. By rationalization the Germans mean all devices for industrial cost reduction. They include even the consolidation of industrial corporations, for such consolidations effect economies in overhead and selling, and lower production cost through plant specialization and the transfer of production from uneconomic to economic factory units.

Consolidations have been going on in large number in Germany. The government has encouraged it by temporarily reducing the taxes, for such consolidation only, on real estate transfers and on issues of stock.

The other many features of rationalization also receive encouragement from the government, through the agency of a trusteesship known as the *Reichskuratorium fur Wirtschaftlichkeit*. It surveys the whole field of methods of cost reduction and furnishes funds, in quite limited amounts however, for such studies as would otherwise not be made. The scope of the studies it assists is very wide, including standardization, reduction in variety, research into production methods, scientific management, and so forth. For further details of its operation the reader is referred to the article already mentioned.

One notable feature of this work is its thoroughness. Wastes that we would say were negligible are not so regarded by the German. If the aggregate figures are fairly large he attacks the problem. There is, in the German point of view, no "chicken feed" in oft-repeated wastes.

In addition to these efforts at cost reduction, with all of which we in America are familiar, and in which (except possibly in research) the Germans acknowledge our leadership, the Germans have a device of their own for reducing cost and stabilizing industry. That device is the cartel, which, in essence, is some type of co-operation, chiefly in selling, price agreement and in allotment of production quotas, between manufacturers who are financially independent. The device is legal in Germany. It extends beyond German boundaries, and there are now a goodly number of international cartels.

On the whole, however, the cartel is not regarded as the cure-all of industrial difficulties that we, looking on from a distance, might be likely to regard it. As a means of meeting a temporary situation it is regarded as admirable. Such situations arrive most frequently out of great over-capacity and consequent ruinous price cutting. The cartel agreement in such cases allots production, and often fixes prices. The selling is frequently done through a central office.

In general, all the producers in a given line will not come into the cartel, and the competitors who stay out are claimed to keep the cartel prices reasonable. In some cases, right after the war, the government forced producers in certain industries to form a cartel or join an existing one. These compulsory cartels, though, proved unsatisfactory, and all of them, except the coal and potash syndicates, have been dissolved. One obvious danger confronting any cartel is that the low-cost producer will withdraw. While, in the cartel, he has the advantage of a price fixed with reference to the costs of the high-cost producer, his quota may be unsatisfactorily low. Unless he can force a higher quota from his fellow members, his interests may be served by withdrawing, and, with his lower prices getting a larger share of the business and loading up his plant. This possibility is further cited by German business men as a protection to the public from possible cartel extortion.

Further, a cartel law was passed in 1924, setting up among other things, a cartel court, to which a member of a cartel may take his grievances and get relief from unwarranted actions of the cartel by securing release from his cartel agreement. The public may also use the cartel court as a means of stopping extortionate prices. Business men insist, though, that appeal to the court for protection of the public is not needed, since competition serves as an adequate regulator. On this point, though, there is disagreement, and one hears expression that the German government is in the power of big business. By these people the cartel law is cited as an evidence of the distrust of the public of the regulating power of competition.

As for international cartels, their function is to prevent cut-throat competition between the industries of different countries. Of these cartels the raw steel combination has recently attracted much attention.

Cartels Not Aimed at U. S.

Asked whether the international cartel was designed chiefly as a means of effective competition with America, German business men just laughed. They maintained that European international cartels will reduce competition instead of increasing it, by eliminating below-cost competition. As a matter of fact, after the raw steel cartel was formed the price of billets rose five dollars per ton.

Indeed the Germans declare that we are the people to be feared as below-cost competitors, dumping on the foreign market. With a huge domestic market and, say, 10 per cent of the production of a commodity going abroad, we can afford to sell that 10 per cent, so they argue, far below cost just to load up our factories. Meanwhile the protection of our tariff barriers enables our manufacturers to get a good price at home.

The cartel, it is pointed out, has one great danger, namely, its encouragement of technical stagnation. If the price protection should prove successful over a long period, there would be a tendency to neglect technical research and development.

We are, of course, trying to effect without the mechanism of agreement the main purposes of the cartel. We collect figures on production, stocks and shipments,

so that when overproduction is threatened each manufacturer will see the wisdom of slowing down. The same figures discourage the increase of capacity by new construction when the market does not warrant it. Moreover, by encouraging sound accounting practice we hope to get all manufacturers to sell their goods at a reasonable profit. Our mechanisms are slower than those of the Germans, but we hope that eventually they may be reasonably effective in stabilizing industry. Already they have been invaluable.

Looked at fundamentally, it is my feeling, after hearing the discussions at Geneva, and talking to people here, that American industry need not fear the competition of German or international groups, merely because they are united in a cartel. There is no wonder-working mechanism in the cartel idea itself. It does not lower production costs, it does not lower selling costs if the selling be modern and aggressive. Therefore if we are "on our toes" technically, if we constantly lower our production costs, we will be able to compete. The crux of the situation is production economy—for us as well as for those joined in a cartel. If we will hammer this home to each other, if we "tend to our knitting" as it were, we need not worry about cartel movements in Europe, though of course we do want, and will want, to learn what is going on. We must know what new and good economic mechanisms may be developing. Further, our strongest competition will come not from financially independent manufacturers united in a cartel, but from large consolidated companies. These are the ones that can make sharp production economies.

This, though, must be borne in mind: Back of our tariff walls we can do whatever we wish as to price levels. If we want to run on a high level that is solely our concern. When we go into a foreign market, however, our goods, value for value, must meet a world price. Price at home and price abroad may be quite different things. Our goods, value considered, must sell lower than German and British and other foreign-made articles. Therefore, we must continue to produce cheaply *from the world standpoint,* while continuing our high wage level.

In addition to establishing foreign relations through international cartels the Germans are establishing good relations with the British that should, at the very least, lead to a better understanding of each other commercially. Last October the British Minister of Transport, Colonel Ashley, invited a group of German industrial leaders to meet a similar group of British industrialists at his home in Broadlands. This month the Germans reciprocated, with Doctor Carl Duisberg, chairman of the board of directors (Aufsichtsrat) of the I.G. Farbenindustrie A.G., as host at Leverkusen, near Cologne. The meetings were small, the number at Leverkusen being twenty-eight. The meetings furnished opportunity for full informal discussion of the business conditions in, and relations between, the two countries. The situation in the iron and steel and the textile industries, the conclusions of the International Economic Conference at Geneva, the proposal for an international court for handling claims arising out of contracts between the nationals of different countries, the relation of agricultural to industrial conditions were some of the subjects discussed. One tangible result was the decision to interchange students in order to promote the business and cultural relations between the two countries.

One dominant impression made on the visitor in Germany is the spirit of open-mindedness among industrialists. Anything new interests them. They want to learn and adopt the best practice in every field. Incidentally, a plea for openmindedness was the strong note of the address on behalf of the German delegation at the Geneva Economic Conference by Dr. Karl F. Von Siemens, head of the Siemens-Schuckert Works. This attitude, too, is reflected in plant policy. If a more efficient machine is available and the money can be found the old one goes out. This policy is not so well applied here as with us, but when capital is available there will be rapid renewal of plant equipment. With this open-mindedness goes great adaptability. One marvels for example at the turnover of large parts of the great Krupp plant from war to peace products. We, of course, made such conversions, but we look on Europe as more conservative, and do not expect such ready adaptability. This adaptability is further shown by the many ways in which the Germans are trying to change their methods and point of view and their whole industrial direction to fit the new conditions resulting from the war.

> For us in the United States the lesson would seem to be this: Just now the competition of Germany is not serious; but as our need for foreign markets grows, and Germany's handicaps are reduced, this competition will be of deep concern to us. To the most intelligent, the most efficient, shall go the greatest reward.

All of which indicates what can be expected of Germany in foreign trade as the handicaps described in the first installment of this article are removed.

This then is the program; these are the efforts that are being made to rehabilitate Germany industrially.

Such plans and efforts require the leadership of men of large capacity; and in them Germany is not lacking. One is constantly inspired by the men he meets here, manufacturers, merchants, bankers,—men of deep knowledge of world conditions and of the technique of commerce and industry, men of vision and courage, men who work unceasingly, it would seem, plan intelligently, and think clearly. There is truly here what the Germans call a "begeisterung," a lifting up, an exaltation of the spirit. That it will produce still greater leaders of world trade no one who stays here for a few weeks can doubt. The strength of the German leaders was indicated at the International Economic Conference. The leaders there of the German delegation—Dr. Karl F. Van Siemens and Clemens Lammers—stood out strongly.

Evidently the Germans are being forced to work as have been no people of modern times. Work, whether mental or physical, develops strength. One may well ask, as a very shrewd German suggested to me, whether the Germans might not be forced to become too strong commercially for the best interests of other industrial nations. Some day the handicaps will be removed; then Germany's competition may be overpowering. At least

it will tax the genius of the rest of the world. History records the story of many nations that have come to greatness through the qualities developed during adversity; so, too, does it chronicle the tale of those that have decayed through ease and luxury.

So, the answers I would hazard regarding the situation in Germany and her future are these:

Germany has made tremendous progress industrially, and against heavy handicaps. She is, however, hampered by conditions that make further progress difficult and slow. She is putting forth great effort; and it is making her industrially strong. Eventually, she will play an important part in the world's commercial affairs. She is adaptable and fits herself perfectly into the conditions and requirements of modern industrialism.

For us in the United States the lesson would seem to be this: Just now the competition of Germany will not have serious concern for the American people at large; but as our need for foreign markets grows, and Germany's handicaps are reduced German competition will be of deep concern to us. Let it not be looked forward to as commercial or industrial warfare. It is but the competition that we as Americans expect among ourselves; to the most intelligent, the most efficient shall go the reward. So too in the future competition in foreign trade. Germany will be a worthy rival; the tools of competition will be the research laboratory, studies in waste reduction, researches to discover new methods and new products, and, finally, hard and intelligent work. We are stimulating Germany now to high endeavor in engineering enterprise and industrial management. She will, in turn, stimulate us. Our future position as against Germany will depend on our technical ability and commercial alertness.

Probably I can do no better than to conclude with the observation made to me by that able German, Dr. Carl Duisberg, head of the great I.G. chemical company. "America," he said, "can undoubtedly keep the economic leadership of the world for twenty or thirty years if her young people are taught to work." (I took him to mean that in that period Germany would be in a position to challenge our leadership, though this he did not say).

In Doctor Duisberg's emphasis upon work is the deep secret of Germany's potential strength. For hard work there is no substitute; and that lesson the Germans have learned.

Sales Expense—Unproductive

UNPRODUCTIVE, or non-productive, as applied to certain types of labor in the plant is an unpopular term with the experts. It is now considered more elegant to refer to such labor, or expense, as indirect.

In the sales department some of the expenses incurred are decidedly indirect, even to the point of being completely unproductive, or non-productive. In fact, they might be referred to, colloquially, as a total loss. For instance:

A prominent builder of machine tools received the following communication, written on a post card, and dated May 7:

Dear Sir:

Please send me more detail description of your 12 and 14 inch swing 6 ft. bead lathes. Your accuracy Bulletin and general Catalogue and be sure and quote me your Price for immediate delivery fob your station do you make a milling attachment for your lathes?

Signed.

To which the sales manager replied that the desired literature was being sent and that the company's nearest agent would call and offer his assistance in the selection of the right equipment and drive for the lathe. This was on May 13.

On May 31 the agent wrote this very illuminating letter to the company:

Gentlemen:

I have followed up many a machine tool prospect but this bird beats any I have been up against yet. I found him on a farm some 10 miles out of Paris—living in the filthiest house I have ever set a foot in—with every thing about the house and farm buildings falling to pieces for want of a little attention. When I finally got him located down in a cotton patch—his wife and some three or four of the oldest kids were "chopping" cotton along with a couple of hired negroes while some three other tots were playing around in the field, all of them barefooted and with one piece garments on. Well—when he found out that it was me come up to sell him a lathe he promptly knocked off work, sent his wife up to the well a half mile off for a fresh bucket of water and proceeded to get ready to buy that lathe from me.

He felt that I had made a mistake in my letter quoting the price, the girl added too many naughts to the figures and forgot to point off the dollar and cents column right, as nobody made a lathe that sold for $1,500.00.

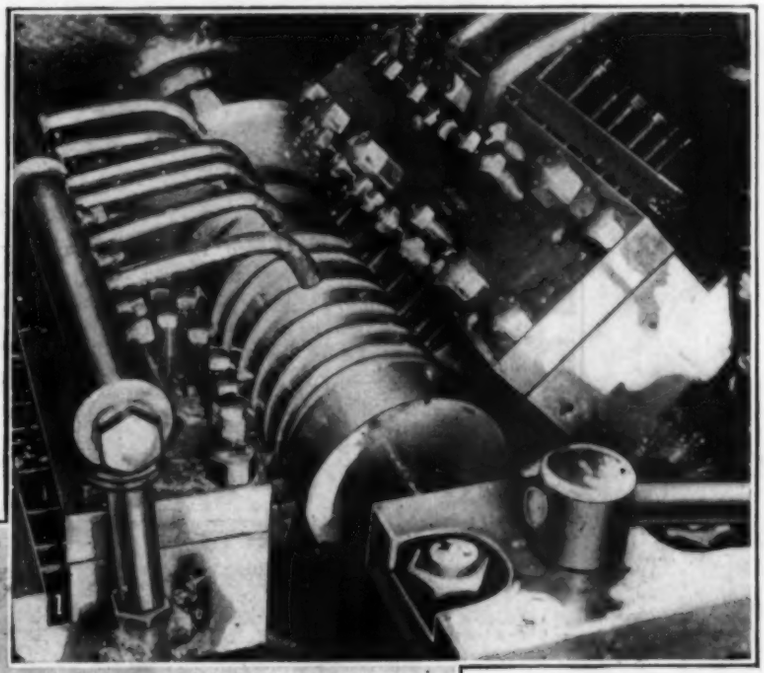
The joke came, though, when I asked him what kind of work he was going to do on this lathe. He said he had several pieces he wanted to make up. He had a perfectly good vise but the screw was worn out and he wanted to make a new one. He also wanted to make a new piece for his mowing machine. Also he had a two-cylinder gas motor that he wanted to fix up. The machine shop man in Paris wanted $18.00 to fix it up—this was too much—they only offered him $3.50 for the whole engine. This was a crime—an outrage, etc.—so he is going to buy his own tools and put up a shop as soon as he makes this cotton crop.

Believe me, it was rich. I got quite a kick out of it. Needless to say, you may expect our order for a lathe, radial and shaper from him this fall.

Best regards. Signed.

Automotive Production

Cylinder Sleeves for Airplane Engines



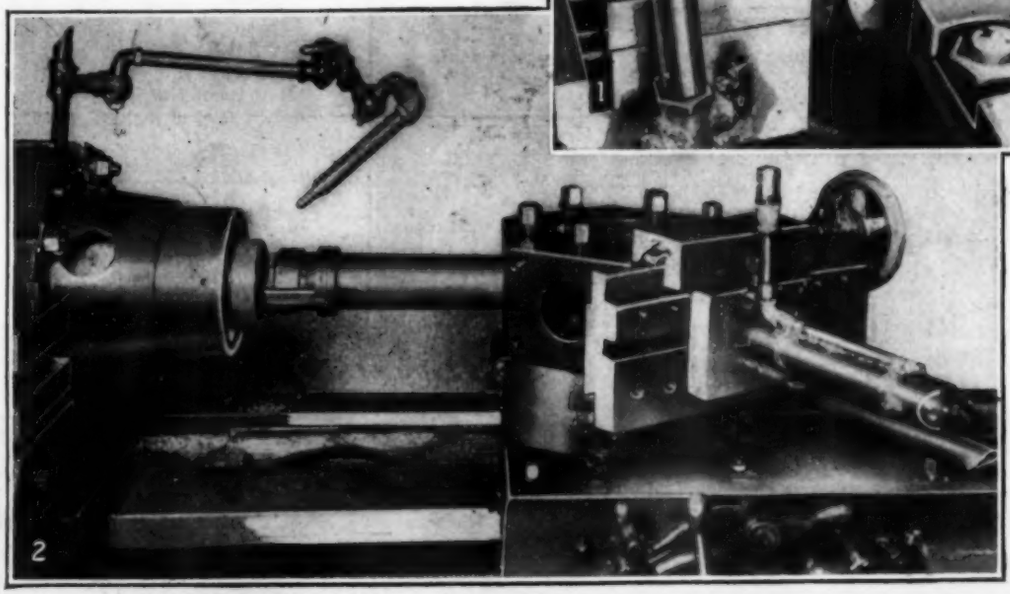
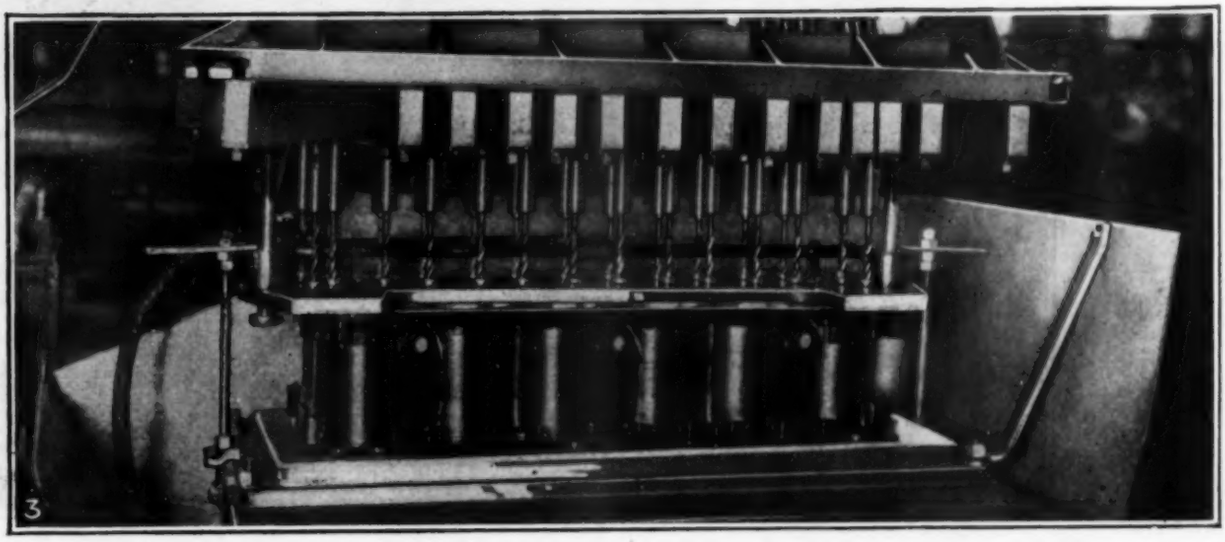


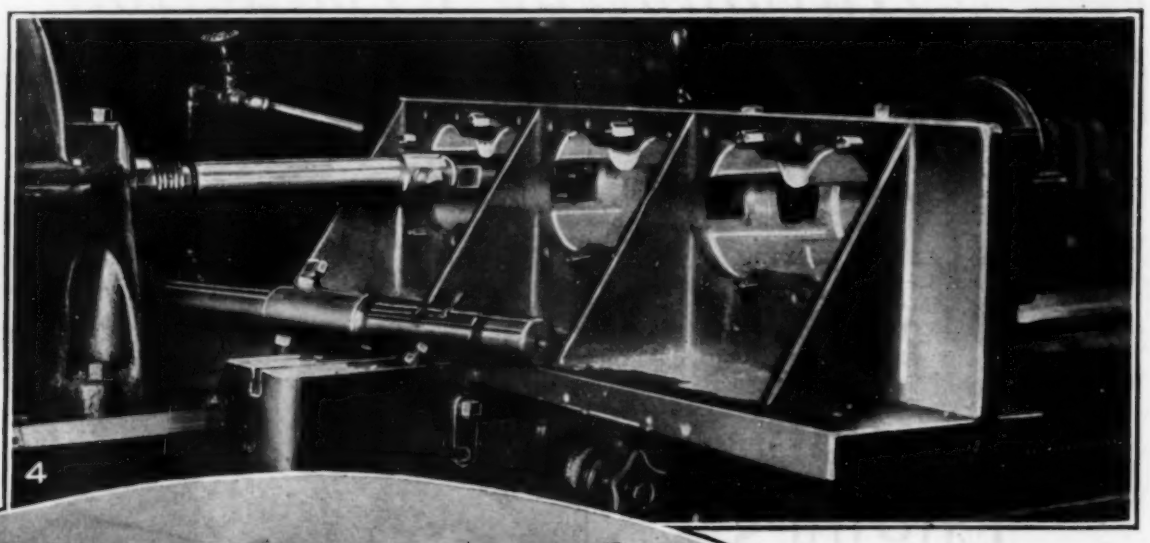
Fig. 1—Turning outside of forged-steel cylinder sleeve on Fay lathe

Fig. 2—Finish boring sleeve in contracting chuck on Libby lathe

Fig. 3—Drilling the 26 holes in the aluminum water-jacket



Automotive Production



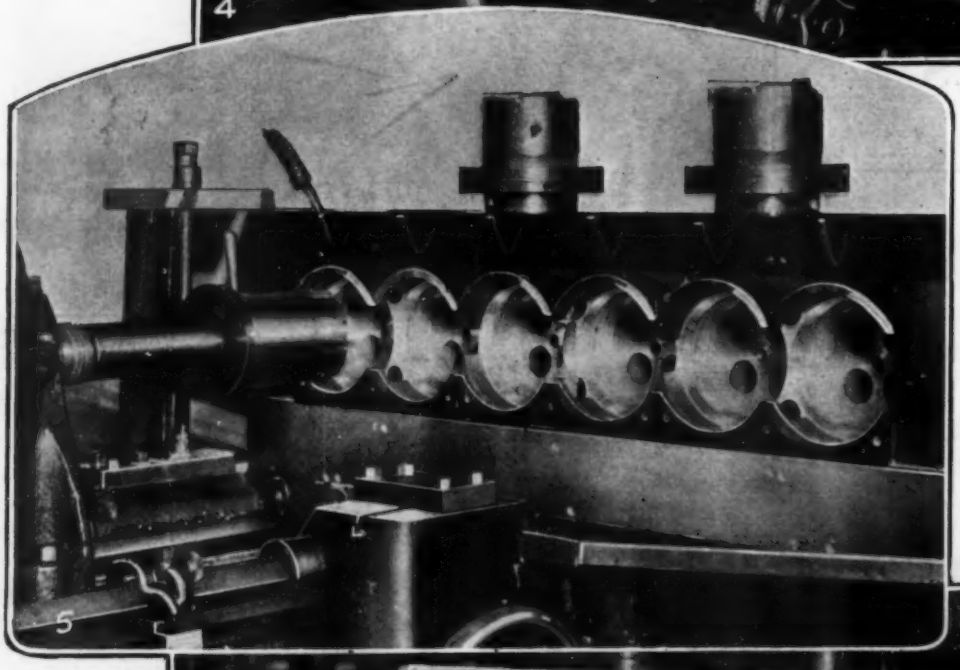
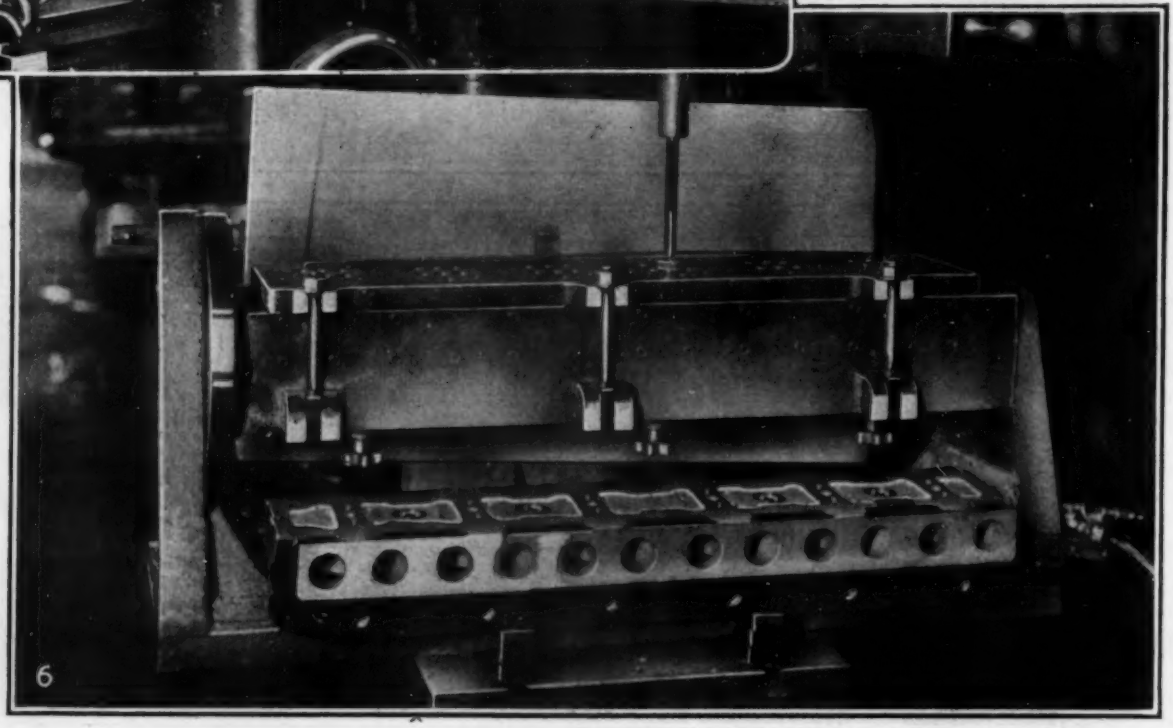


Fig. 4—Boring the water-jacket casting while held against an angle plate

Fig. 5—Boring cylinder heads. They are of aluminum and are cast in one piece

Fig. 6—Drilling the cylinder head on three sides in a trunnion fixture. This fixture allows the completion of all the holes at one setting



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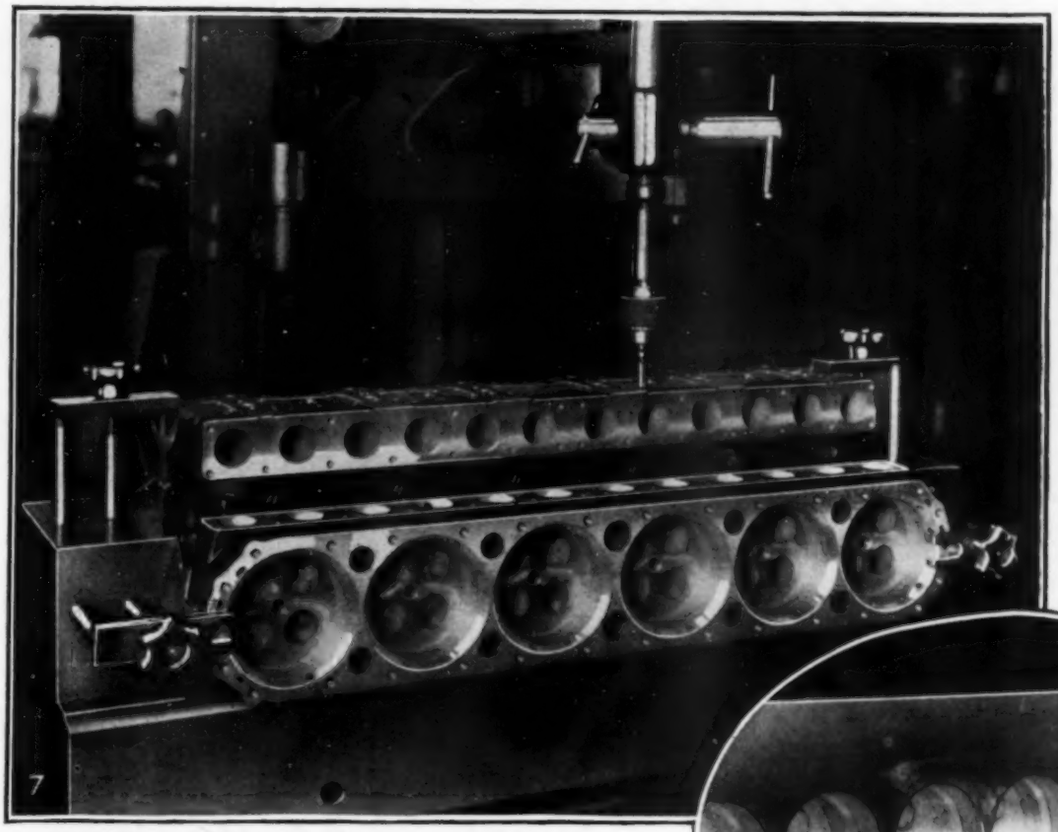


Photographs by courtesy of the Curtiss Aeroplane and Motor Co., Inc., Buffalo, N. Y.

Fig. 7—Tapping cylinder head for studs. In this fixture it is possible to tap nearly all the holes in the cylinder head at a single setting

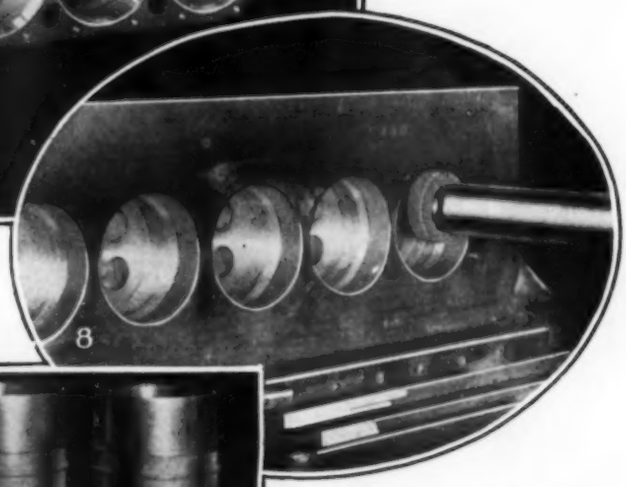


Fig. 8—Grinding bottom of cylinder-head recess to insure a perfect seat for the steel cylinder-sleeve

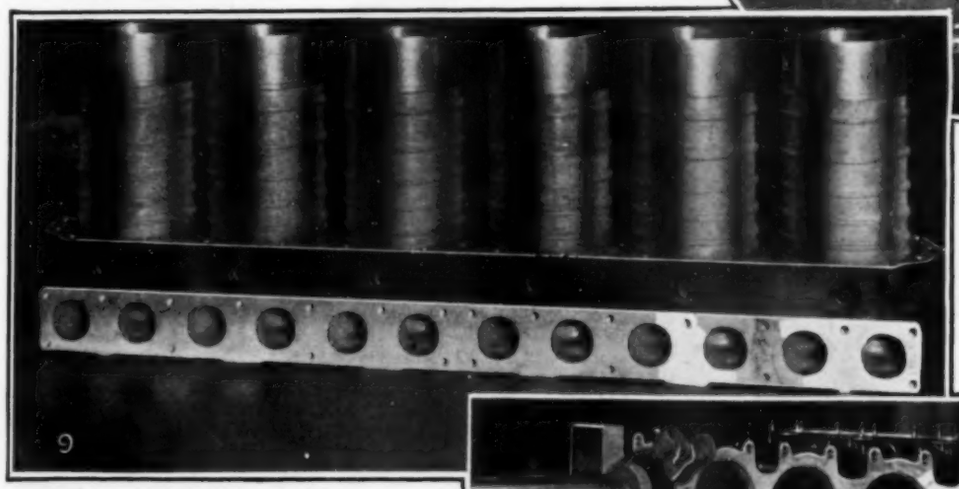


Fig. 9—Six cylinder-sleeves screwed into place in the aluminum cylinder-head casting

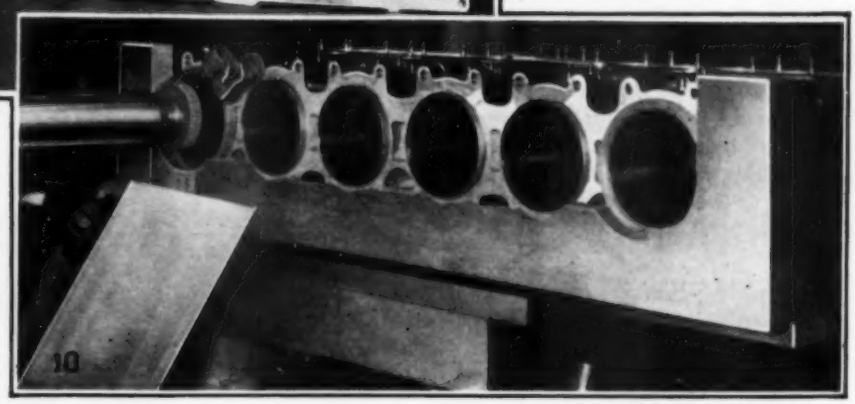
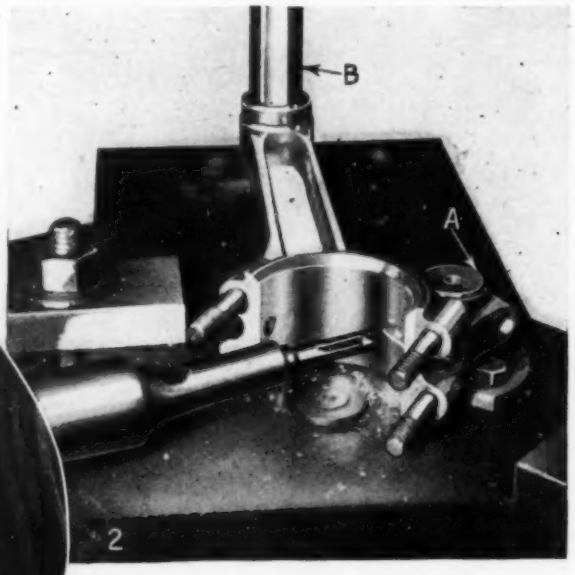


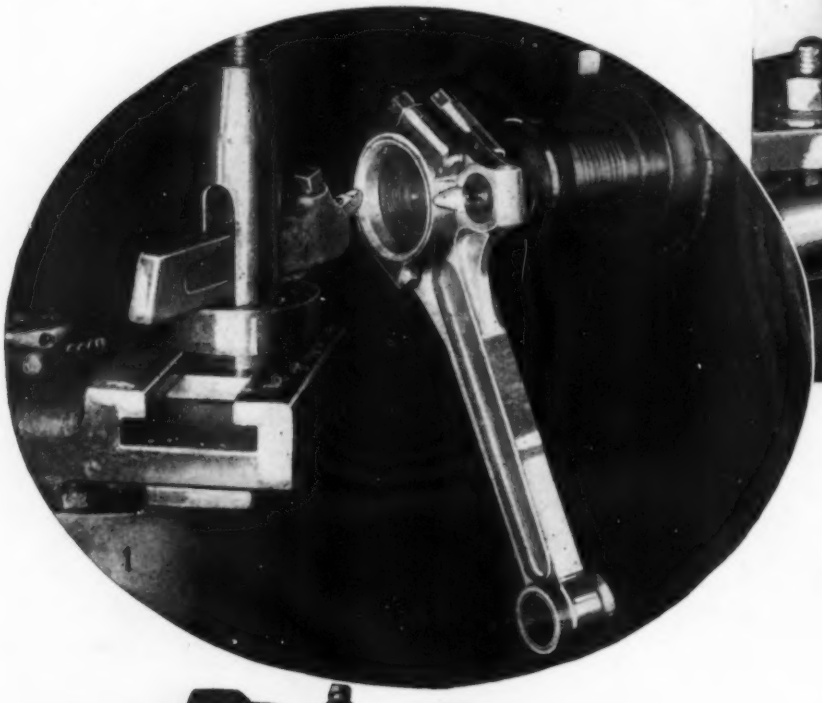
Fig. 10—Finish grinding the sleeves after they have been screwed into the aluminum head to counteract distortion

Automotive Production

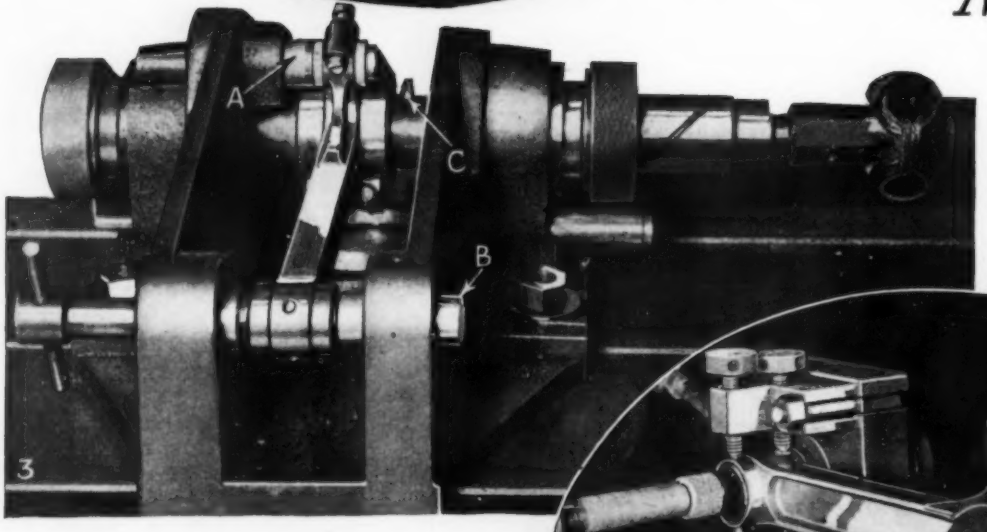
Fig. 1—The master connecting rod. This rod has three bearings, the piston pin, the crankshaft pin, and the bearing for the small or auxiliary rod

Fig. 2—Milling the oil pocket in connecting-rod bearing for small pin. The connecting rod is positioned by the stationary pin, A, and the removable pin B





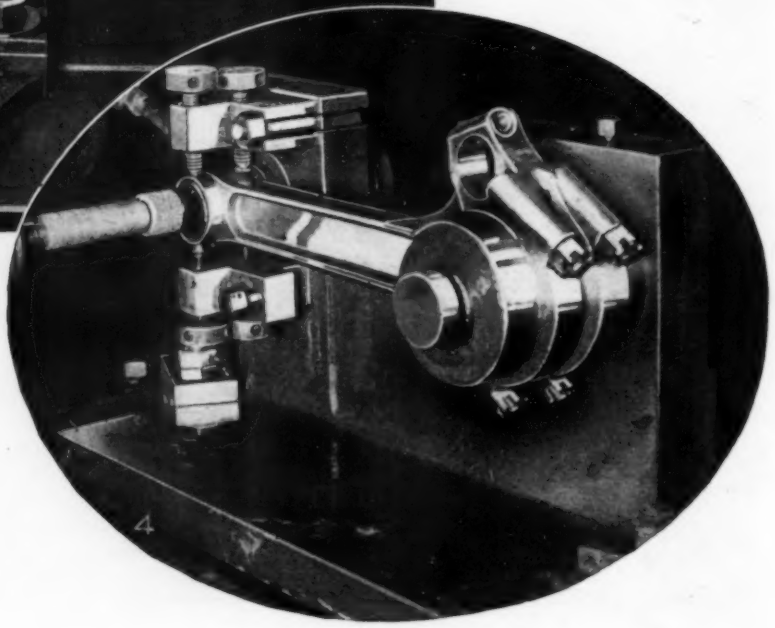
Unusual Connecting-Rod Methods



Photographs by courtesy of the Curtiss Aeroplane and Motor Co., Inc., Buffalo, N. Y.

Fig. 3—Finish boring the crankpin bearing. The master connecting rod is mounted on the stud A and is held by the movable pin at B. The flycutter C is then revolved rapidly, and fed slowly

Fig. 4—Finish grinding piston-pin bearing. The rod is mounted on an angle fixture and positioned by the stud in large end. The small end is then adjusted by knurled screws



Machining and Measuring Gear Teeth

By EARLE BUCKINGHAM
Associate Professor of Engineering Standards and Measurements, Massachusetts Institute of Technology

Development of the true involute helicoidal surface of a hob for generating involute gears — Variation of this form from that of the straight-sided rack section

LET us now direct our attention to the problem of the hob. At the present time, this problem seems to be one of great importance. The hob consists of a practically straight-sided, worm-shaped cutter, the axial section of which represents the projected form of the basic rack of the gear tooth system. If the axis

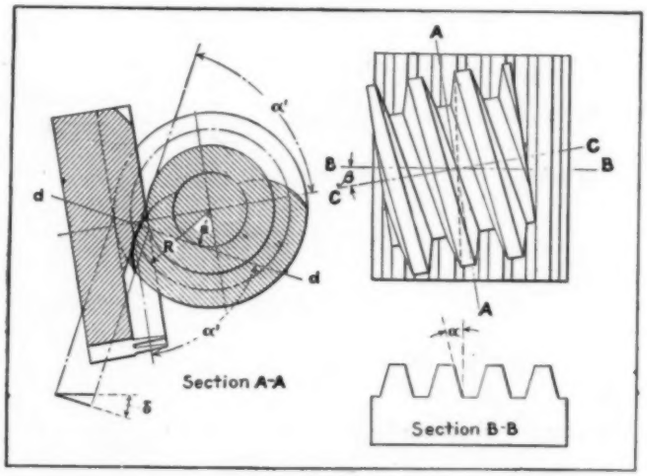


Fig. 41—Theoretical rack and hob

of the hob were set at a right angle with the axis of the gear blank, its axial section would represent the form of the basic rack. As the hob is usually set at an angle to the gear blank that corresponds to the helix angle of the hob at its pitch line, the angle of the hob tooth and its lead must be altered accordingly.

Thus, let

α = angle of side of basic rack
β = angle at which hob is set
α'' = angle of side of hob tooth
P = circular pitch of basic rack
K = lead of hob.

Then $$\tan \alpha'' = \frac{\tan \alpha}{\cos \beta}$$

$$K = \frac{P}{\cos \beta} \text{ for single-threaded hobs}$$

$$K = \frac{2P}{\cos \beta} \text{ for double-threaded hobs}$$

$$K = \frac{nP}{\cos \beta} \text{ for multiple-threaded hobs, where } n = \text{number of threads or starts.}$$

A common fault of gears produced with the ordinary form of hob is that the portion of the involute profile near the tip of the tooth does not make proper contact. Using shop terms, the gear teeth often have a "low bearing." In other words, the involute profile seems to be distorted in such a manner that additional metal is removed at this point. A slight modification at this point is often beneficial, but too much will shorten the duration of contact. On gears with relatively small tooth numbers, where the duration of contact is short at best, excessive modification at this point results in noisy gears.

Multiple-threaded hobs prove much faster producers than single-threaded ones, but they are seldom used except for roughing cuts because of the large errors that develop in the tooth profiles of the product. The

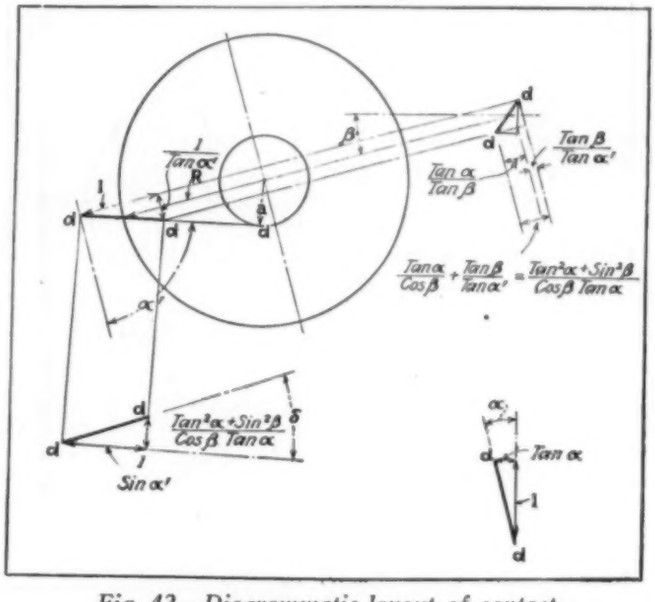


Fig. 42—Diagrammatic layout of contact between rack and hob

The sixth article. The seventh will appear in an early issue.

cause of these errors is one problem of the hob to be considered.

As stated before, the hob is usually set at an angle to the gear blank. Some hobs are now made for spur gears that are set square with the axis of the gear blank. Considerable uncertainty exists in regard to the effect of setting a hob at various angles. The fundamental differences, if any, between a hob set at an angle and a hob set square is another problem to be studied. The effect of varying the angular setting of the hob is still another problem.

Many of the difficulties of hobbing accurate gears are blamed on the distortion of the hob in hardening. Such distortion is a serious handicap and will always be one of the most difficult problems to solve. Grinding the hob after hardening is possible but expensive, particularly grinding the relieved surfaces of a hob. Regardless of hardening defects, however, if it should prove that the ordinary practice in making hobs introduces defects in the form of a product that can be eliminated, the chances of getting a good hob through the hardening process would be greatly increased.

An involute gear is generated from a straight-sided rack. Theoretically, a hob that will generate a true involute gear will also generate a straight-sided rack. Although, for practical reasons, a hob would never be used to cut a rack, we will use one in the study of the hob because its straight-line profile is the easiest one to deal with.

The simplest example of such a hob is an involute helical gear of one tooth (a single-threaded worm, in other words) running with a straight-sided rack. For the present, all considerations of relief, nature of cutting flutes, and other refinements will be ignored. This hob consists of an infinite number of spur gears twisted uniformly to give the lead of the helix. In Fig. 41, such a hob and rack are illustrated.

In this illustration, let

a = radius of base circle of involute in section *A-A*
R = radius of pitch circle of involute
α = angle of side of straight-sided rack tooth

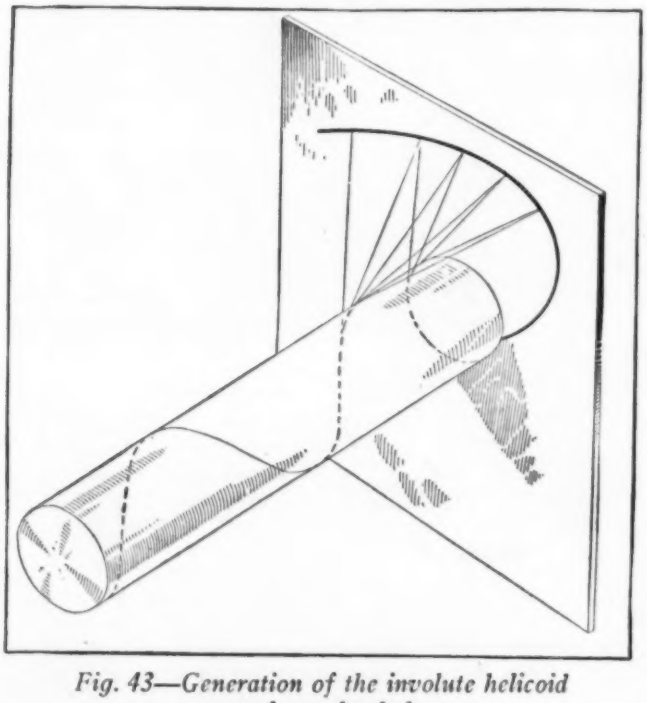


Fig. 43—Generation of the involute helicoid surface of a hob

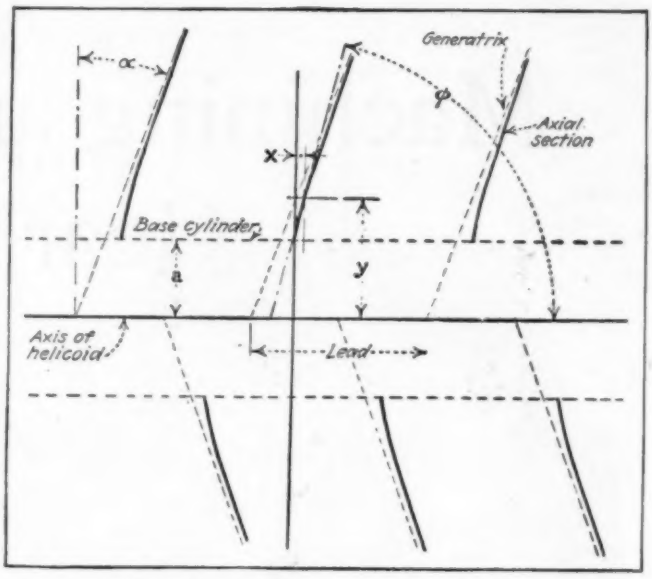


Fig. 44—Axial sections of an involute helicoid, general case

α' = pressure angle of involute in section *A-A*, which is also the projected angle of α in section *A-A*

β = angle at which hob is set, which is also the helix angle of the hob at radius R

M = module of rack = $\dfrac{1}{\text{diametral pitch}}$

P = circular pitch of rack = πM

K = lead of hob.

Referring to Fig. 41, we have

$$\tan \alpha' = \frac{\tan \alpha}{\sin \beta}$$

$$K = \frac{P}{\cos \beta}$$

$$\tan \beta = \frac{K}{2\pi R} = \frac{P}{2\pi R \cos \beta} = \frac{M}{2R \cos \beta}$$

Whence $\sin \beta = \dfrac{M}{2R}$ or $R = \dfrac{M}{2 \sin \beta}$

In section *A-A*, the line *d-d* is perpendicular to the side of the projected section of the rack tooth and passes through the intersection of the centerline and pitch circle of the hob. This line *d-d* is therefore the line of action of the involute and the rack. We already know that contact between an involute and a straight line can only take place along such a line of action. The circle concentric with the hob to which this line *d-d* is tangent will be the base circle of the involute. Whence,

$$a = R \cos \alpha'$$

Considering now the infinite number of successive sections of the involute which are twisted uniformly to the lead of the hob, we see that contact between the straight-sided rack and hob must be in a straight line because the projection of the line of contact in the plane *A-A* is the straight line *d-d*, and this line of contact also lies in the plane of the straight-sided rack tooth. If the angle of this line of contact with a plane perpendicular to the axis of the hob is determined, we would generate the surface of the teeth of a hob of correct form by revolving this line of contact, advancing it according to

the lead of the hob and keeping it tangent to a cylinder of the same diameter as the base circle in section *A-A*, just determined. In section *A-A* this line is at the angle α' from the horizontal. In section *B-B* it must be at the angle α from the vertical because this line of contact must be in the plane of the side of the rack. The angle δ in section *d-d* is the desired angle. Fig. 42 shows only the lines required to establish this angle. It is merely a problem in descriptive geometry. The contact line *d-d* is shown in heavy lines in the four projections. The projection lines enable their construction to be followed. The same projection plans are used as in Fig. 41, which should also be consulted. The values of the lengths of the different lines are indicated on the diagram. From these we have,

$$\tan \delta = \frac{(\tan^2\alpha + \sin^2\beta)\sin\alpha'}{\cos\beta \tan\alpha}$$

But $$\sin\alpha' = \frac{a \tan\alpha}{R \sin\beta}$$

Substituting in the foregoing equation, we have

$$\tan\delta = \frac{a(\tan^2\alpha + \sin^2\beta)}{R \sin\beta \cos\beta}$$

But $$\tan^2\alpha = \sin^2\beta \tan^2\alpha'$$

Substituting, we have

$$\tan\delta = \frac{a\sin\beta(\tan^2\alpha' + 1)}{R\cos\beta} = \frac{a\tan\beta(\tan^2\alpha' + 1)}{R}$$

$$\tan\beta = \frac{K}{2\pi R}$$

Substituting, we have

$$\tan\delta = \frac{aK(\tan^2\alpha' + 1)}{2\pi R^2}$$

$$(\tan^2\alpha' + 1) = \frac{1}{\cos^2\alpha'}$$

Substituting, we have

$$\tan\delta = \frac{aK}{2\pi R^2 \cos^2\alpha'}$$

But $$R\cos\alpha' = a$$

Whence $$\tan\delta = \frac{K}{2\pi a}$$

But the tangent of the helix angle of the hob at radius a is equal to $\frac{K}{2\pi a}$

Therefore, the surface of a hob that will generate a straight-sided rack or an involute gear is developed by revolving and advancing with uniform lead, a straight line inclined at any given angle to the plane perpendicular to the axis of the hob, provided this line remains tangent to a cylinder of such a diameter that the helix angle at that diameter is the same as the angle between the generatrix and a plane perpendicular to the axis.

The characteristics of such a surface can be visualized by winding a string around a cylinder on a helix as shown in Fig. 43. The cylinder would represent the base cylinder of this involute helicoidal surface. Both ends of the string can be tied around the cylinder, one at each end. The bight of the strong should then be held so that at one end of the cylinder the string is perpendicular to the axis and at the other end it is at an angle. Then when the cylinder is revolved, winding the string about it, one part of the string will be wrapped around in the form of a helix while the other part will be wound upon itself. The angle at the bight of the string will remain constant, and that part of the string which is at an angle will be a continuation of the helix angle on the base cylinder. As the string is unwound again, the corner of the bight will trace an involute curve on a plane perpendicular to the axis of the cylinder while the angular part of the string would develop an involute helicoidal surface. It will be noted that the straight-line form of this helicoidal surface will be its intersection curve with a plane tangent to its base cylinder and not its intersection curve with an axial plane. This feature of the involute helicoid makes it simple to determine the characteristics not only of hobs but also of helical involute gears whose surfaces are also involute helicoids.

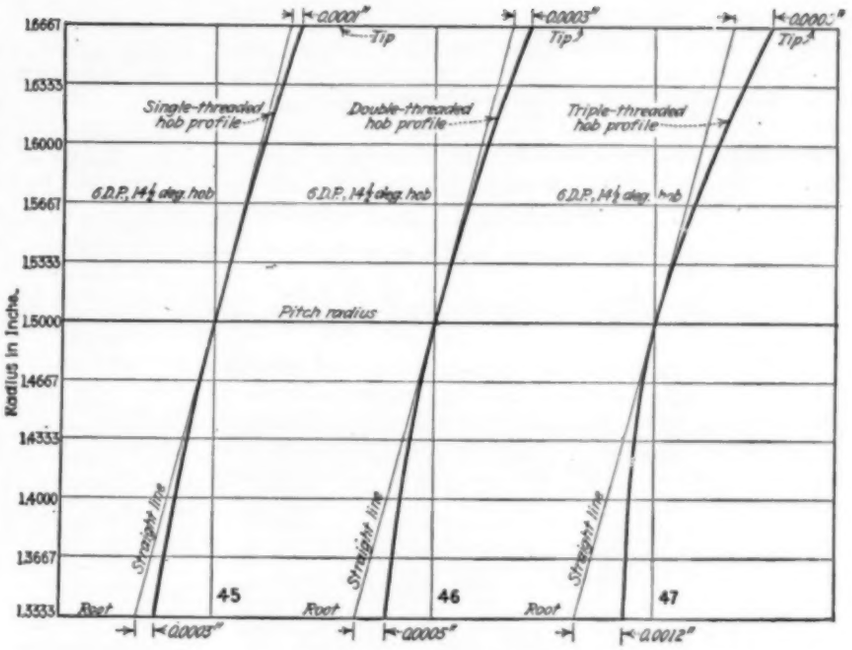


Fig. 45—Axial section of a single-threaded hob. Fig. 46—Of a double-threaded hob. Fig. 47—Of a triple-threaded hob

The equation of the axial section of an involute helicoid, shown in Fig. 44, is as follows:

$$x = \frac{K}{2\pi}\left(\frac{\sqrt{y^2 - a^2}}{a} - \arctan\frac{\sqrt{y^2 - a^2}}{a}\right)$$

Where x = distance along the axis of the helicoid

y = radius to any point of the helicoid.

The equation of the tangent to this curve, measured from the x-axis, is as follows:

$$\tan\phi = \frac{dy}{dx} = \frac{2\pi a y}{K\sqrt{y^2 - a^2}}$$

When the tangent at the pitch line is desired, as is usually the case, y becomes equal to R and the equation of the tangent reduces to the following:

$$\tan\phi = \frac{2\pi a R}{K\sqrt{R^2 - a^2}}$$

$$\frac{2\pi R}{K} = \frac{1}{\tan\beta}$$

$$a = \frac{R\sin\beta}{\sqrt{\tan^2\alpha + \sin^2\beta}}$$

Substituting these values, we obtain:

$$\tan\phi = \frac{R\sin\beta}{R\tan\beta\tan\alpha} = \frac{\cos\beta}{\tan a}$$

From the preliminary analysis we have:

$$\tan\alpha'' = \frac{\tan\alpha}{\cos\beta} \quad \text{whence} \quad \tan\phi = \frac{1}{\tan\alpha''}$$

As definite examples, we will calculate and plot the profiles of single-, double-, and triple-threaded hobs of the same diameter and pitch. We will take 6-D.P. hobs, 14½-deg. pressure angle, with a pitch diameter of 3 in. For the single-threaded hob we obtain the following values:

$\alpha = 14\frac{1}{2}°$

$R = 1.500$ in.

$M = 1/6$

$$\sin\beta = \frac{M}{2R} = \frac{1}{6\times 3} = 0.05556$$

$\beta = 3° 11' 5''$

$$K = \frac{P}{\cos\beta} = \frac{0.5236}{0.99845} = 0.52441 \text{ in.}$$

$$a = \frac{R\sin\beta}{\sqrt{\tan^2\alpha + \sin^2\beta}} = \frac{0.08333}{0.31264} = 0.31503 \text{ in.}$$

Solving the equation for the profile we get:

y	x	$(x-0.27405)$
1.3333	0.23116	—0.04289
1.3667	0.23972	—0.03433
1.4000	0.24828	—0.02577
1.4333	0.25686	—0.01719
1.4667	0.26545	—0.00860
1.5000	0.27405	0
1.5333	0.28265	+0.00860
1.5667	0.29126	+0.01721
1.6000	0.29989	+0.02584
1.6333	0.30852	+0.03447
1.6667	0.31715	+0.04310

Solving the equation for the tangent at the pitch line we get:

$\tan\phi = 3.86068$, $\phi = 75° 28' 45''$,

whence $\alpha'' = 14° 31' 15''$

These values are plotted in Fig. 45. The theoretical profile of the axial section of this hob is practically a straight line, departing from it about 0.0003 in. at the root of the hob tooth and less than 0.0001 in. at the tip of the hob tooth. Thus, if this hob were made with a straight-line axial section it would introduce a slight modification at the tip of the hobbed gear of less than 0.0003 in. in the direction that tends to avoid edge contact.

We will now direct our attention to the double-threaded hob of the same pitch and diameter. For this we have the following values:

$\alpha = 14\frac{1}{2}°$

$R = 1.500$ in.

$M = 1/6$

$$\sin\beta = \frac{2M}{2R} = \frac{2}{3\times 6} = 0.11111$$

$\beta = 6° 22' 46''$

$$K = \frac{2P}{\cos\beta} = \frac{2\times 0.5236}{0.99381} = 1.05372 \text{ in.}$$

$$a = \frac{R\sin\beta}{\sqrt{\tan^2\alpha + \sin^2\beta}} = \frac{0.16667}{0.28147} = 0.59213 \text{ in.}$$

Solving the equation for the profile, we get:

y	x	$(x-0.19496)$
1.3333	0.15209	—0.04287
1.3667	0.16058	—0.03438
1.4000	0.16910	—0.02586
1.4333	0.17768	—0.01728
1.4667	0.18630	—0.00866
1.5000	0.19496	0
1.5333	0.20365	+0.00869
1.5667	0.21237	+0.01741
1.6000	0.22113	+0.02617
1.6333	0.22991	+0.03495
1.6667	0.23872	+0.04376

Solving the equation for the tangent at the pitch line we get:

$\tan\phi = 3.84274$, $\phi = 75° 24' 48''$

whence $\alpha'' = 14° 35' 12''$

These values are are plotted in Fig. 46. This profile is also practically a straight line, but it shows a greater departure than on the single-threaded hob. In this case the departure from a straight line at the root of the hob tooth is about 0.0005 in. while it is about 0.0003 in. at the tip. These amounts are roughly double those on a single-threaded hob. This departure introduces a greater modification in the tooth profiles of the hobbed gear when a straight-sided axial section hob is used than before.

We will now direct our attention to the triple-threaded hob of the same pitch and diameter. For this we have the following values:

$\alpha = 14\frac{1}{2}°$

$R = 1.500$ in.

$M = 1/6$

$$\sin\beta = \frac{3M}{2R} = \frac{3}{3\times 6} = 0.16667$$

$\beta = 9° 35' 40''$

$$K = \frac{3P}{\cos\beta} = \frac{3\times 0.5236}{0.98601} = 1.59309 \text{ in.}$$

$$a = \frac{R\sin\beta}{\sqrt{\tan^2\alpha + \sin^2\beta}} = \frac{0.25000}{0.30767} = 0.81256 \text{ in.}$$

Solving the equation for the profile, we get:

y	x	$(x-0.14031)$
1.3333	0.09775	—0.04256
1.3667	0.10605	—0.03426
1.4000	0.11447	—0.02584
1.4333	0.12299	—0.01732
1.4667	0.13162	—0.00869
1.5000	0.14031	0
1.5333	0.14909	+0.00878
1.5667	0.15794	+0.01763
1.6000	0.16687	+0.02656
1.6333	0.17586	+0.03555
1.6667	0.18492	+0.04461

Solving the equation for the tangent at the pitch line we get: $\tan\phi = 3.81258$, $\phi = 75° 18' 11''$, whence $\alpha'' = 14° 41' 49''$.

These values are plotted in Fig. 47. The profile here makes a noticeable departure from a straight line, departing about 0.0012 in. at the root of the hob tooth and

about 0.0009 in. at the tip. In this case these amounts are over four times as great as those on a single-threaded hob. This would introduce too much modification on the tooth profiles of a gear produced with a straight-sided hob, if quiet running gears are required.

With the same diameter of hob, as the pitch becomes greater, the departure from a straight line profile will also become greater because both the helix angle and the depth of tooth will increase.

It should be apparent from the foregoing why single-threaded hobs with straight-line tooth profiles prove more satisfactory than multiple-threaded ones. There is no theoretical reason, however, that would prevent more satisfactory multiple-threaded hobs from being made if the profile is properly corrected. This can be accomplished in a simple manner by setting the straight-sided tool used to cut the threads on the hob a suitable distance off center.

Air-Operated Tools Help Repair Locomotives—Discussion

By John Brown

THE article by Frank W. Curtis, under the title given above, on page 979, Vol. 65, of the *American Machinist*, would not be of fullest value if it did not call forth some sort of comment. For that reason the following method of removing and applying fittings used in the repair of steam hose is described:

A pneumatic power device for removing or applying the nuts from, or to, the four ½-in. bolts used to hold the clamps, is shown in Fig. 1. These bolts cost approximately two cents each, and 98 per cent of them are good for further service.

Air is piped to the device so that when one of the bolt heads is placed in the vise *A*, and air is admitted to the cylinder *B* by a foot valve, the action of the air closes the vise and at the same time starts the motor. The operator then lowers the revolving socket-wrench *C* upon the nut. In applying nuts, the motor is run in the opposite direction.

Removing the fittings from the hose is done in a different manner from that described by Mr. Curtis. The hose is placed in the device shown in Fig. 2. Air applied to the cylinder *A* causes the piston to bring down the end of the arm *B*, in which is held a sharp knife at *C*. Thus the hose is slit. Provision is made for adjusting the travel of the arm so that the knife will cut through the rubber without striking the part of the fitting inside the hose. The operator, by a twisting motion can easily remove the fitting.

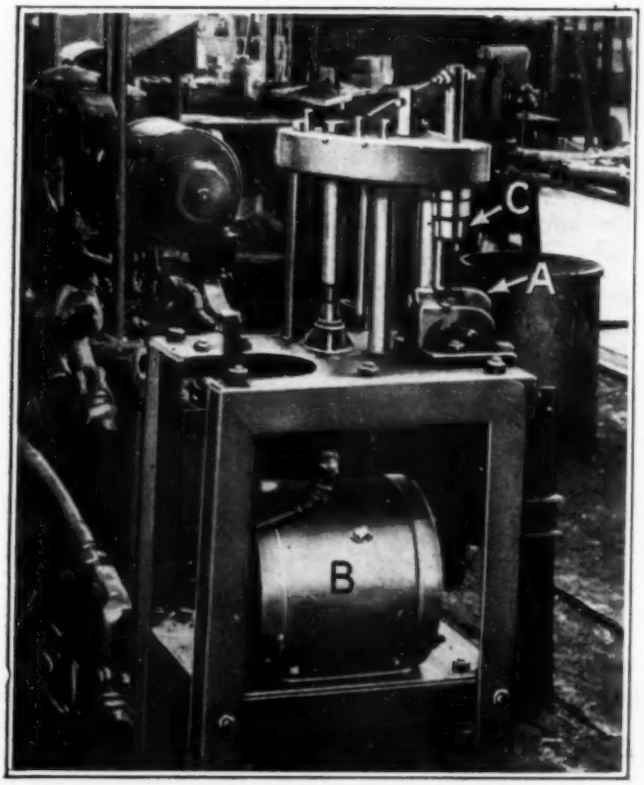


Fig. 1—Power device for removing and applying nuts

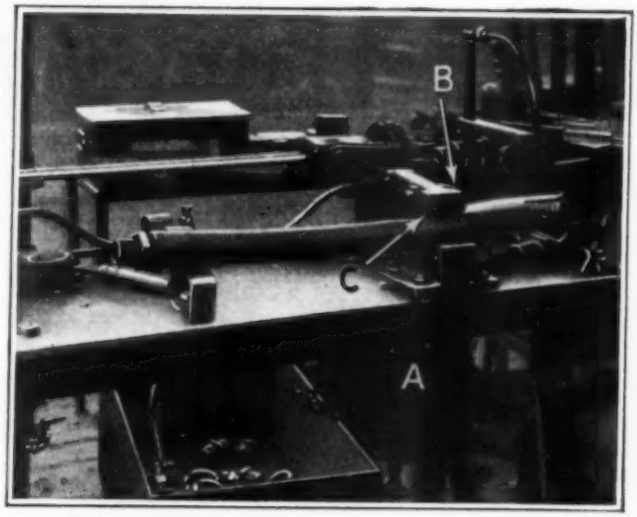


Fig. 2—Machine for slotting the ends of hose

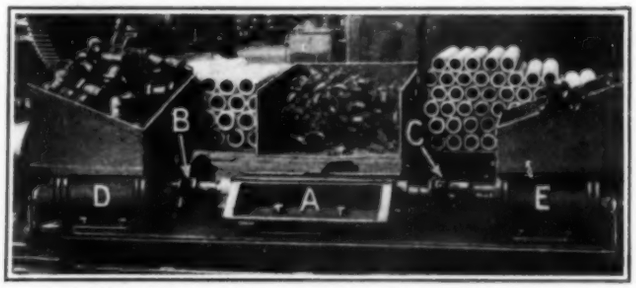


Fig. 3—Machine for applying fittings to new hose

Fittings are applied to new hose in the device shown in Fig. 3. The hose is held in the vise, or clamp, *A* and the fittings are placed in the holders *B* and *C*, attached to the pistons of the air cylinders *D* and *E*. Admitting air to the cylinders, forces the pistons toward each other and seats the fittings.

In ordinary practice, fifty steam hose can be demounted and the fittings re-applied to new hose as follows: Remove nuts and take off the two-section clamps, 1 hr.; slit hose and remove fittings, 22 min.; re-apply fittings and clamps to new hose and tighten nuts, 2 hr. 20 min. Total 3 hr. 42 minutes.

THE · FOREMAN'S · ROUND · TABLE

Solving the Vacation Problem

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"WELL, Al, I think I got a few tips on that shop visiting trip to the city last week," said Ed, as he rescued his tray from a collision at the noon lunch cafeteria and settled down to eat. "But one of the things that struck me most wasn't in the machine line at all. Didn't put it on my report because I kinda think Williams feels I'm an elephant in a china shop when it comes to management ideas."

"What's the big idea, Ed? What did you see?"

"It was down at the Excelsior plant. Seems they have something over a thousand employees there, and they have a vacation bonus plan that kills several birds with one stone.

"Everybody rings up on the time clock, but nobody is docked for being late. If an employee has a perfect record of no lates and no absences for the month he gets half a day vacation credit. That means that he can earn a week's vacation each year. It works whether or not there's a vacation plan already going. In that plant they already have vacations for office help, and the bonus days count extra. Seems they take them half a day at a time, or the whole six days at one whack."

"How does it work out, Ed?"

"Fine! The big majority of the help earn the bonus right along. It solves the problem of continual nagging about lateness, and you know, Al, there's nothing like having a man right on the job when it's time to start production moving. His lateness usually upsets others, and docking doesn't seem to help.

"Then, isn't it a good solution for the problem of vacations in the shop? You know how the shop men feel when the hot days come and they see the office help getting vacations handed to them."

"But how about the piece workers, Ed?"

"Easy, Al, they get a day rate for vacation time."

"It don't look half bad, Ed. But you made a mistake not putting it in your report. Better send in a supplementary report and see how it strikes Williams."

Is tardiness a costly annoyance?
Would a time bonus be more effective than docking?
Are vacations for the shop practical?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Using Makeshift Tools

THE use of makeshift tools on production work is not a paying proposition. To use them is generally expensive from the beginning. The man who promises to set up the job in an hour from something or other around the place, usually falls down badly on his "guestimate." Somehow the first pieces are spoiled, but after many adjustments and some new adaptions, production starts again. Perhaps it goes along all right for a while, at least if tolerances are not too exacting, but in much too short a time the cycle of reconstruction and adaption starts all over again. Barring accidents, and makeshift tools certainly invite them, the parts then must be "talked through" inspection, and in the end, if the company has a proper pride in its product, everyone who had a part in the makeshift tools and their products, feels sheepish about them. On experimental and development work, however, makeshift tools are often a true economy. One of the foreman's greatest opportunities to establish his value to his concern is when, if past experience has convinced him that it is false economy to tinker with makeshift tools, he will assert his opinion. If he's right, it is certain he will not be overruled many times. Proper tools are a first cost only while makeshift tools will often lead to an additional cost for proper tools, charging off the makeshift job as a dead loss. And what is even more disheartening, proper tools will often cost more after a makeshift failure than if they had been made in the first place, due to the bad impression left on the men by the failure. There is seldom any excuse for makeshift tools on the regular production work, and the foreman who tolerates them is only courting trouble for himself.

—JOHN HEFFERMANN.

Consulting the Foreman on Tool Design

THE practice of consulting the foreman on the design of tools will work wonders toward maintaining harmony. Any progressive foreman will take pride in co-operating witih the tool designer and offering the benefit of his experience. Oftentimes, also, he may be able to suggest a simpler design. Then, when the tools are completed, the foreman will have a special interest in seeing that they work. In my own experience as toolmaker and tool designer, I have seen more than one tool or fixture completed and sent into the shop only to be condemned, mainly because of the lack of co-operation. It is reasonable to suppose that the foreman knows the requirements of the job better than the tool designer, and from previous experience with the job he can often suggest things that would not occur to the designer.

As to whether the workman who is to use the tool should approve the preliminary sketches, I should leave this entirely to the judgment of his foreman. However, if I knew the workman to be of the sort who cared to do some thinking for himself, I should suggest it to the foreman.

—P. H. WHITE.

FROM a long experience as a tool designer, and a considerable one as chief tool designer, I can guarantee the correctness of all the advantages quoted by Al as gained from the co-operation of foreman and tool designer in responsibility for design. However, there are occasions when the tool designer and the foreman can not agree, and also there are organizations where the system is to consult the superintendent of the machine shop. There is one disadvantage to the plan championed by Al, and that is its tendency to lessen the initiative and responsibility of some tool designers. Under it they incline to rely on the foreman instead of working their own inventive resources to the utmost. The foreman does not always have the courage to risk his signature on a design that he has not seen tried. In such cases, the tool designer should be free to go ahead on his own initiative. In the event of the design involving a large expenditure, the approval of the superintendent should be obtained. The workman's criticism should be invited, and his suggestions as to possible improvement, but I think it is asking too much to require his approval. "Too many cooks spoil the broth," and too many signatures lessen the sense of individual responsibility. The highest efficiency is secured when full and free consultation and co-operation between worker, foreman, superintendent, and tool designer, is combined with the maximum of responsibility and control by the design department. Friendly relations between all concerned is the foundation of this achievement.

—JOHN J. WOFFINGTON.

CONSULTING the foreman on the design of tools eliminates friction between production and designing departments, and if the foreman is wide awake he will study the best machine suitable for the job and bring out a number of details that the tool designer might overlook, all of which tends to increase the efficiency of the jig or fixture.

Many tools fall down after completion because of little details in the machining of the part that were overlooked by tool designers or checkers. The toolroom foreman should also O.K. tool designs and make suggestions. Hav-

THE · NEXT · TOPIC

Saving Money with a New Machine

QUESTIONS

Will posting facts about costs of a new machine stimulate interest in it?

Does it help to have all hands know what a new machine must do to pay for itself?

Does it help a foreman to learn more about the job higher up?

ing the workman sign is going too far with this method, for only exceptional men would be able to understand the design from the drawings, and time would be lost in explaining. —J. J. BROWN, *Tool Supervisor.*

Should the Foreman Get a Bonus?

ANY scheme that tends to increase the earnings and standing of foremen ought to be encouraged. A bonus scheme, based upon both the performance of individual departments and the profits of the concern as a whole will achieve that result. The first part may be figured in inverse proportion to the cost of work plus departmental cost, and in direct proportion to the volume of work. At the time of payment the figures for the first part should be discussed with foremen individually. The payment may be quarterly, but returns should be made weekly to show progress. Those for the second part should be presented periodically to the foremen as a body, such explanation as is desirable being given and discussion invited. —S. C. MILLER.

IT IS ridiculous that a foreman should be granted a bonus in addition to his daily rate, if the same is not granted to the men themselves. Even his superiority in his trade or his rank would not warrant such a venture. He should be on time every morning as well as the workmen, and he should ascertain that production starts at the time designated. Since these are part of his duties extra consideration should not be tendered for what he is already paid. A bonus for the foreman would create dissatisfaction among the workmen, and they too, would deem themselves justified in demanding extra consideration for their daily production, and would place the employer in a situation where he has no alternative other than acceding to the demands of all the men concerned. —PETER HAGEN.

IN PLANTS where the production is largely on a piece-work basis the foreman possibly originates a large percentage of the ideas for labor-saving devices. If he gets a bonus he will have a keener interest in the cost of production, and will co-operate more readily with the cost department in keeping costs uniform. He will be more likely to listen to the suggestions of men under him on ways and means of reducing costs. He will take a personal interest in his help in reference to their health. He will be on the alert for any change in the construction of articles manufactured under his care which would make easier their production. It will also be to his advantage to have a new job and material as near ready as possible when a man completes one order. In combining these ideas, it is readily seen that the foreman who receives a bonus is earning larger dividends for the company. He is also more interested in his help and their success. A foreman is only human, and the bonus will stimulate him. —H. CLARK.

Applying the Budget to Small Tools

IF WILLIAMS can answer accurately how many holes will a drill make with one grinding, or how many grindings is the life of a drill, then he can budget the small tools. He probably would say that a drill, a set of taps and reamer, ought to do the job. Then he is only guessing, not budgeting. Suppose these tools do not, for various reasons, finish the job. The cost of issuing a slip for replacement tools and keeping record of them, and the necessary accounting, will soon eat up the price of several of the needed tools. The small-tool budget is another of the "penny wise, pound foolish" theoretical systems for saving money that are putting many a profitable shop on the financial rocks. —ERIC HAWTHORNE.

FEW men realize the number of tools they spoil in a month's time, and less men know the value of these tools. If a budget system does nothing else but let each man know these factors, the saving would more than pay for the detail necessary to keep the records. Individual pride of each workman will accomplish the results desired. But production may be delayed if new tools are not easily secured, and the man nurses a dull tool. It may be humiliating for the foreman to ask for more tools. These are the conditions that the foreman must give thought to, and lay plans to avoid. The budget system is not put in the shop to check the honesty of the men. The foreman who thinks so will never benefit by such a system. If he realizes that it is an effort to supply him with accurate information regarding a detail of shop cost that will help him to control, the chances are it will prove the means of reducing the cost of small tools.

—CHARLES H. GODSHALL.

A BUDGET for small tools will work all right if handled right. I have always liked the manner in which the Rock Island Railway Shops at Silvis, Ill., handled tool supplies. Every machinist, whether on the floor or on machines, was given a certain allowance of tools, which were charged to him. The machinist on the floor was given a two-wheeled truck fitted with a box about 3 ft. long, 1 ft. deep, and as wide as the truck. The machinist could have this box furnished with trays to suit himself. The company furnished the lock.

In the box were placed all the tools that a machinist would ordinarily need, and the machinist was compelled to check every tool and sign for it. He was also given ten tool checks with which he could get any extra tools he might need at the tool crib. Every man looked after his own outfit, and when tools were lost or broken, he had to get a signed release from his foreman before new tools were issued to him. However, worn out tools were exchanged for new ones at the crib without an order.

—C. G. WILLIAMS.

Keeping Down the Work in Process

THE modern manufacturing organization with its staff of engineers and designers is ever anxious to place on the market the latest product conceived through the most improved methods. This can be done only by careful co-operation between the time-study man and the engineering department. The time-study man must keep the work in process at a minimum so that in the event of a new design or better productive methods either or both may be incorporated immediately without the necessity of "junking" or stocking obsolete parts. Assuming that absolute perfection is an impossibility, we must always look for a better product and a better process, and we must always be ready for both.

—R. E. PATERSON, *Draftsman.*

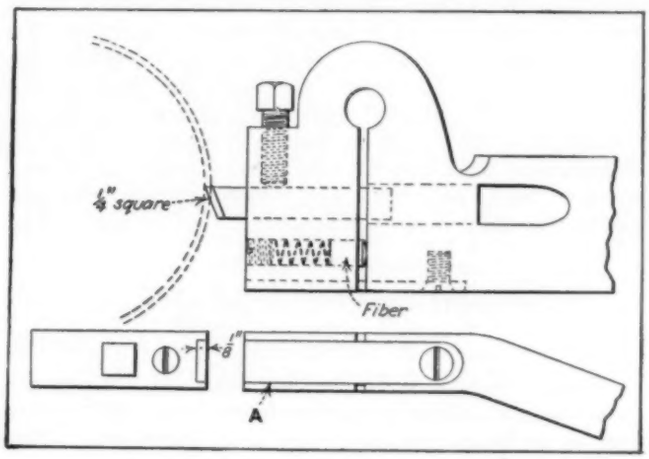
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

An Improved Threading Tool

By George H. Feltner

One of the objections to the spring-type of threading tool is that side play on heavy cuts results in chattering. This condition does not exist in a heavy-type tool, or when a light cut is being taken, but in such cases, the effect of the springing action is generally lost. By using a toolholder made as illustrated, a considerable improvement has been found in the finish obtained in the threads. The improvement is the result of the addition of the



Toolholder that eliminates side play

plate *A*, attached in a groove in the bottom of the rigid part of the tool holder, and fitting a channel in the bottom of the springing part.

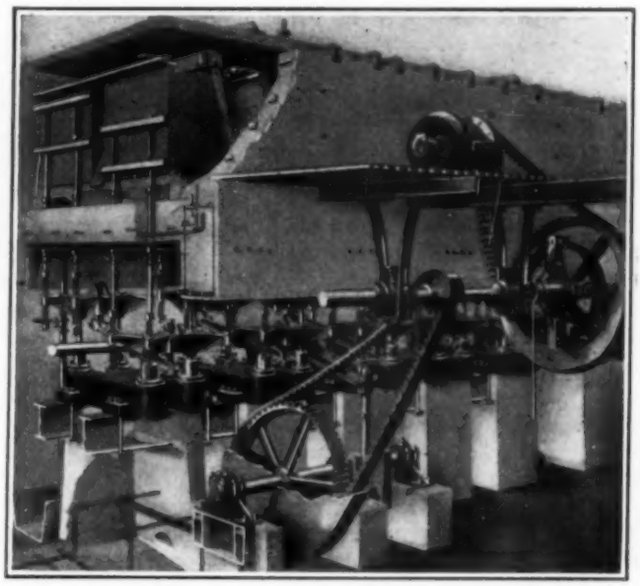
The plate, while allowing free action as to spring in the proper direction, prevents any twisting or side motion of the springing part.

Illustrating Machines by Line Drawings —Discussion

By C. B. Irmer

In an article on page 904, Vol. 66, of the *American Machinist*, C. G. Williams brings out the value of line drawings in presenting a machine to the prospective buyer, and I agree with him that there are occasions when artistic drawings are not only helpful, but are almost a necessity.

The accompanying illustration shows a type of wash-drawing that we use to show the operation of a machine to the non-technical buyer. The class of machine shown goes to municipalities, the higher officials of which are usually not familiar with engineering drawings. The



An artistic picture from a line drawing

line drawings are therefore given into the hands of a technical draftsman, who makes up the type of perspective wash-drawing shown, which is then photographed for use. These photographs show clearly the working of the important details of the machine, which would not be apparent to the non-technical man from a line drawing or from an ordinary photograph of the machine. A perspective wash-drawing such as shown in the illustration represents about 180 hours of work of the technical draftsman in making it from the line drawing.

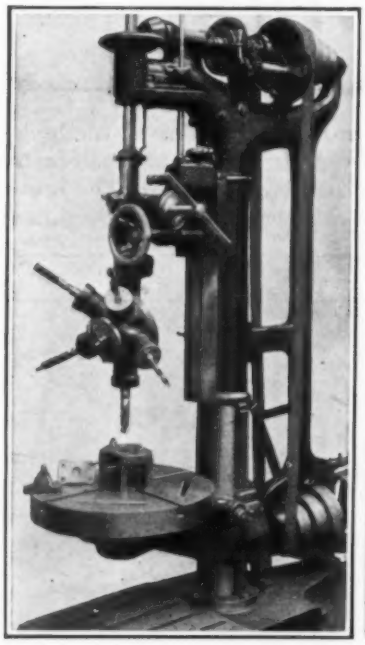
A Turret for the Drill Press

By J. A. Long

The turret toolholder shown in Fig. 1 attached to a standard single-spindle, upright drill press is intended only for shops wherein there is a limited amount of production work within its scope, but not sufficient to warrant the installation of the necessarily expensive multi-spindle or special drilling machines. It is attached to the machine merely by clamping it to the lower end of the quill, to which it is held by the grip of a single clamping bolt.

Turning to the sectional view Fig. 2, we may study the construction of the device. The body is composed of two main parts: the stationary member *AA*, the upper end of which is bored to fit over the quill, split down one side of the bore to permit it to be clamped, and provided with the clamping bolt *B*, passing through suit-

able lugs, to secure it; and the movable member *C*, which is a five-position turret having a corresponding number of short spindles *D*, each running upon its own ball radial and thrust bearings and having a small bevel gear



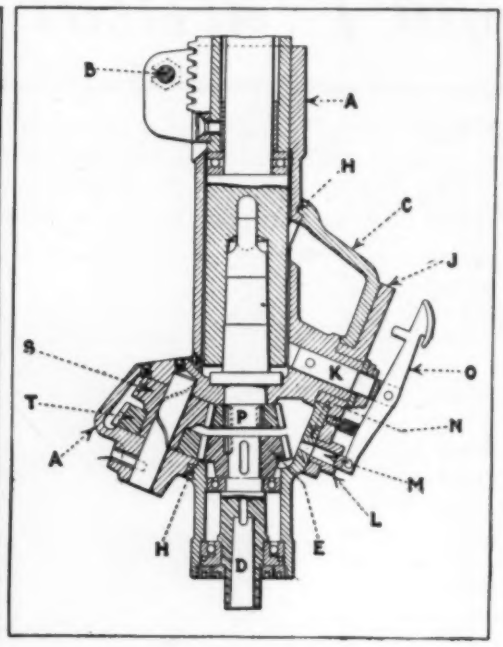


Fig. 1—A turret for the drill press. Fig. 2—Sectional view of the turret

E permanently keyed to its upper end. The sectional view can, of course, show but one of these spindles and its attached parts.

The turret has a full bearing at its largest diameter at *HH* on the stationary member and is confined thereto by the disk *J*, which is fixed to the boss of the stationary member by means of the tightly-driven and taper-pinned stud *K*, to which it is splined and further secured by a nut and friction washer. The disk *J* and its retaining nut and washer thus provide the means to adjust the turret so that it will be held firmly upon its seat at *HH*, yet not tightly enough to prevent rotation by hand.

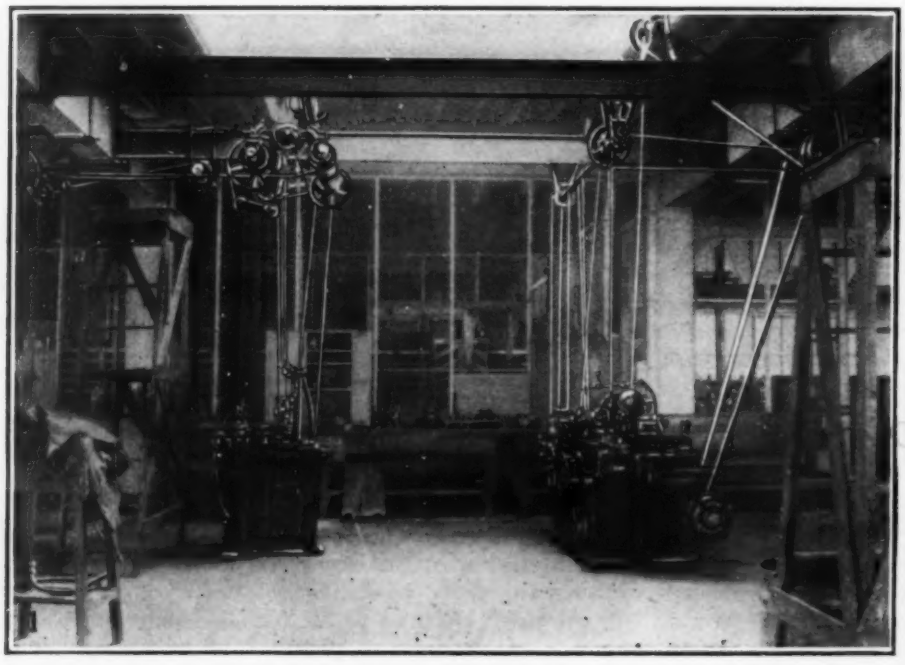
Through the single bushing *L* in the disk *J*, the sliding pin *M* enters any one of five equidistantly spaced bushings *N* set in the top of the turret, and thus locks the latter in its working positions. The active end of the locking-pin *M* is tapered to fit the correspondingly tapered bores of the bushings *N* and is normally held firmly in engagement therewith by a coil spring. The conveniently located hand lever *O*, fulcruming in a yoke at the outer end of stud *K*, provides means to unlock the turret when its position is to be changed. A standard taper shank, fitting the spindle-hole of the machine, carries at its lower end the bevel gear *P*, which is securely keyed to it. In a chamber at the rear of the stationary member, or body *A*, two bevel gears *S* and *T* rotate upon a floating stud being driven by the gear *P*. Though made as two pieces, these gears are firmly secured together and rotate as one. The upper gear *S* is always in mesh with the gear *P* on the shank. The lower gear *T* meshes with the gear *E* on the short spindle of the turret, and passes into and out of mesh with one or other of the several gears *E* each time the turret is indexed. To facilitate engaging them when the movement is made, the tops of the teeth in gear *T* and of the five gears *E* are rounded.

With this device drills, reamers, counterbores, etc., of different sizes can be used consecutively as in any standard turret machine. The change is made from one tool to the next with a minimum of effort and delay.

Supporting Overhead Drives

By Frank C. Hudson

Where machine tools are not equipped with motor drives by the builder it frequently becomes quite a problem to apply motors advantageously afterwards. This



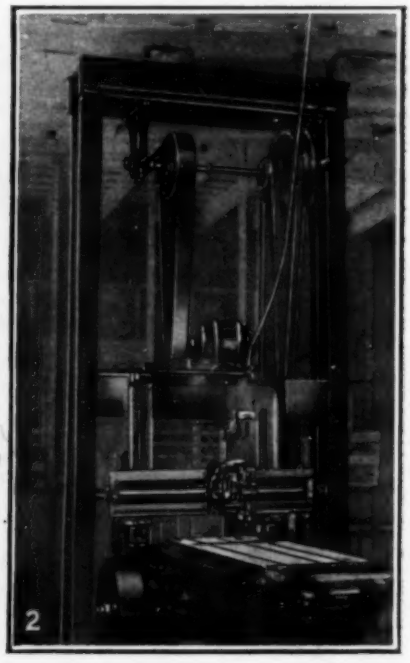


Fig. 1—Overhead motor support for grinders. Fig. 2—Mounting for planer motor

is particularly true where the machines should be self-contained if possible and where more than one drive belt is necessary, as with planers or grinders. This was the problem presented to the shop executives at France Field, the Panama Canal-Zone flying field, and the illustrations show how the machines and their drives were arranged.

Two grinding machines, used in motor overhauls and similar work, were placed together as in Fig. 1 and the overhead works were mounted on I-beams placed between two roof girders. The ends of the I-beams are supported by suitable connections that go around the roof girders. This arrangement allows all the overhead works to be placed directly over the machines to be driven, and gets everything out of the way of the operators. The skylight overhead gives excellent light for the finest kind of work.

Another arrangement is shown in Fig. 2 for driving a planer. Here a frame is built up around the planer, using I-beams and channels. The motor is mounted on a cross member between the two uprights and is belted to the countershaft from which the planer is driven.

Aid to Horizontal Measurement in Lathe Work

By Stephen C. Miller

Perhaps one of the most common and awkward measurements a machinist is called upon to make is that of the lengthwise sizes on shafting and similar items, when undergoing machining in the lathe. The difficulty is increased when the length is great or there are large variations in diameter.

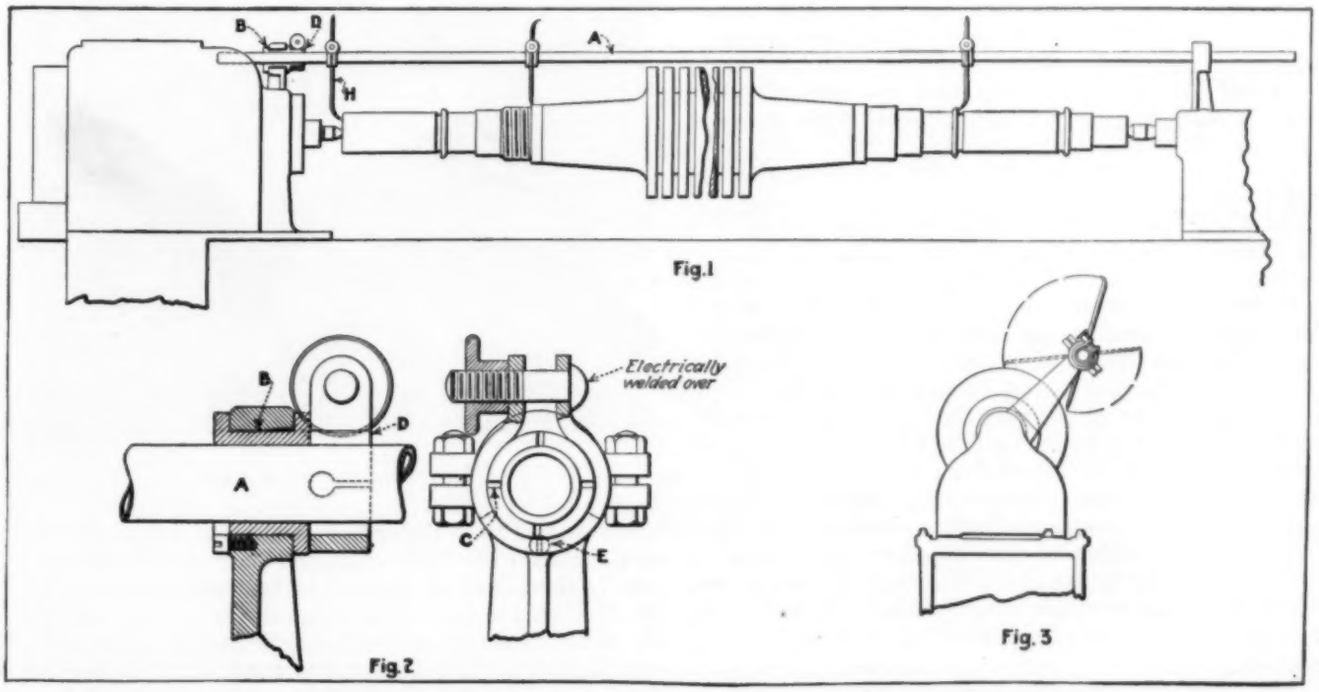
Fortunately such measurements are not often required to be made to very close limits, but there are cases such as are met with in turbine, turbo-blower, turbo-generator and similar class of work, where a considerable degree of accuracy is essential. Apart from the question of tolerance, however, much time can be wasted and errors can creep in, even when the work is only of ordinary accuracy. The application of a length stick, or rod, to a large piece of work cannot be readily made by one man, and to insure that measurements are made in a plane parallel to the axis of the lathe centers, great care must be observed.

The device illustrated will be found most useful in such circumstances. Referring to Fig. 1, the pipe, or bar, *A* is supported in brackets behind, and parallel to, the center line of the lathe. In the bracket at the headstock end is the bushing *B*, collared on both sides of the bracket to prevent lateral movement. The bushing, free to revolve in the bracket within certain limits, has an extension, or hub, that is split in four places, as at *C* in Fig. 2. The split extension can be compressed to grip the rod *A* by the clamp collar *D*, thus allowing the rod and bushing to revolve in the bracket, and permitting the rod to be moved longitudinally in the bushing when the clamp collar is loosened. Rotative motion of the bushing is limited by the stop screw *E* and a cut-away portion of the left-hand flange.

Clamp collars at various positions on the rod carry caliper legs that can be set to indicate certain longitudinal dimensions previously determined, by setting the caliper legs to a rule laid on the shears of the lathe. It will readily be seen that with the rod adjustable longitudinally, the caliper legs can be brought into any lengthwise position of the work without disturbing their relative positions, and that by clamping the rod to the bushing, the rod can be rotated, as shown in Fig. 3, to bring the caliper legs either toward or away from the work, without disturbing their settings.

After one end of the work has been faced, it is turned end-for-end and the rod is adjusted to bring the caliper leg *H* in contact with the faced end. Thereafter, indicating the various lengthwise measurement is a simple matter.

The device is not intended to take the place of the usual stops provided in turret lathes and other manufacturing machines, but is for use in cases where the work is varied or is of large dimension.

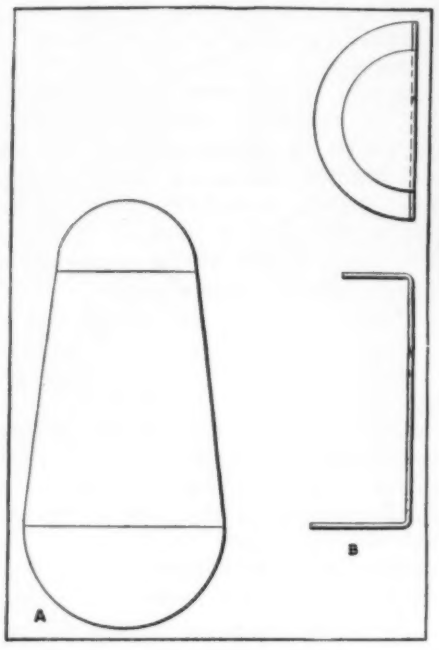


Device for indicating longitudinal measurements on long work

Development of a Truncated Cone —Discussion

By J. Homewood

In reading over the article by John K. Francis under the title given above, on page 535, Vol. 66, of the *American Machinist*, I recalled a scheme used by a sheet-metal worker acquaintance in laying out a pattern for a similar job. In this case, he was given the size of the top, bottom, and height of the truncated cone. His method of procedure was to lay out on a scrap piece of sheet metal the longitudinal section, as shown at *A* in the illustration, and adding thereto semicircles equal in radii to half the size of the ends. These semicircles were folded up at right angles to the main section, shown in *B*. The edges of the ends were chalked and rolled on the sheet to be used as a pattern, thus generating half of it at a time.



Templet for developing a truncated cone

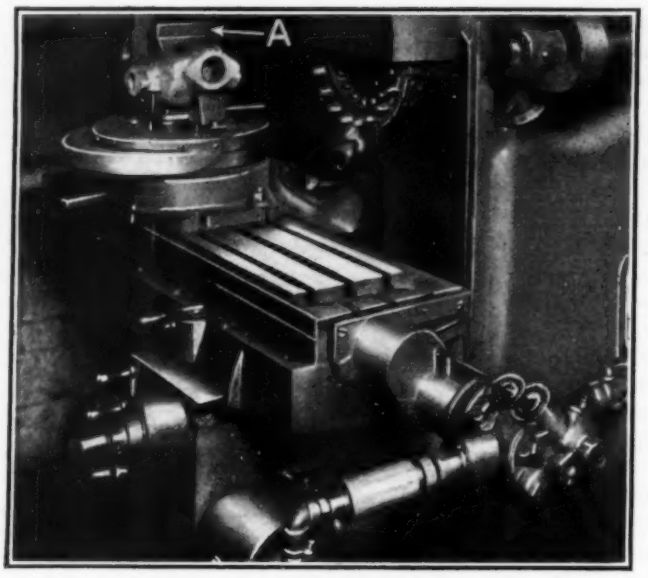
This method can also be used where the top is cut off at an angle with the base, but since the theoretical shape of the top is elliptical, the pattern generated will be slightly in error. However, the connecting piece is usually circular, so that the joint can be assembled properly. Various forms of transition pieces can easily be developed this method, which lends itself to small jobs only, wherein the making of the rolling piece incurs no waste of material.

Air-Operated Milling Machine Table

By Clifford H. French

In order to increase production in the milling of the four faces of the heating unit used in the carburetor system on the Franklin engine, the milling machine shown in the accompanying illustration has been fitted with an air motor in place of the usual drive from the feed box at the right. A standard air motor is attached to the end of the milling machine table by the castings shown, suitable speed reduction being secured by gears inclosed in the case, one of which is attached to the feed screw. The operation of the air motor is controlled in the usual way, by means of the sleeve on the handle, and the operator has complete control either for the cutting operation or for returning the fixture to the loading position.

The aluminum casting is shown clamped in the indexing fixture, in which it can readily be revolved so as



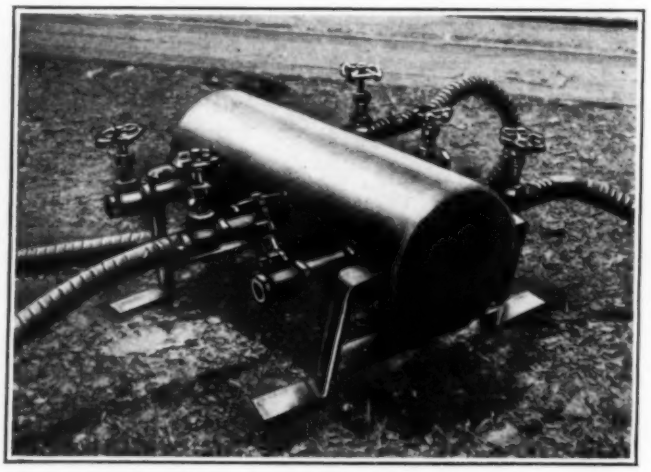
Air motor feed for milling machine table

to present either face to the milling cutter. The fixture is easily handled, the casting being laid on the supporting jaw shown, and the equalizing block *A* placed in position and fastened by means of an easily operated screw above it. This device has made possible considerable time saving, and has converted a machine of the older type into one capable of high production.

Compressed-Air Distributer at Panama

By Herbert F. Crawford

While watching repairs being made to one of the locks in the Panama canal recently I saw an air distributer, or header, that seemed to be very useful. Instead of running long air hose lines to each tool in use, one long



Distributor for an air line

line was run from the compressor to the header shown, and the air tools were connected to this with comparatively short lines of hose. The header was perhaps 12 in. in diameter and 30 in. long, so that it held enough air to act as a reservoir and supplied all the tools without difficulty. The header was made from a piece of large pipe, with heads welded in and the feet welded on near each end.

Thermit Welding

Thermit is the trade name of a mixture of finely divided aluminum and iron oxide, which reacts to produce a superheated liquid steel at 5,000 deg. F. The principle of the thermit process is the chemical affinity of aluminum and oxygen. Up to a temperature of 2,800 deg. F., thermit is an inert mixture. At that temperature, however, the mixture ignites and the aluminum combines with the oxygen of the iron oxide, the iron being set free and melting down as a highly superheated steel of about twice the temperature of ordinary molten steel. If steel at this temperature is poured around sections to be united it will melt both sections and consolidate with them so that the whole will cool to form a single homogeneous mass, or fusion weld.

Plain thermit, which is the mixture of aluminum and iron oxide, is used in making pipe welds where the thermit is merely used as a heating agent to bring the pipe ends up to a welding temperature. Railroad thermit is plain thermit, with the addition of 17 per cent of nickel, manganese and mild steel punching. This grade of thermit is used for all steel welds. Cast-iron thermit is plain thermit with an addition of 3 per cent of ferro-silicon and 20 per cent of mild steel punchings. It is used for welding together cast-iron pipe.

In making a thermit weld, the parts to be united are lined up with a space between the ends to be welded, and the adjacent ends cleaned by a sandblast or other suitable means. A wax pattern is then formed around the ends to be united of the exact shape of the reinforcement of thermit steel which is to be cast. A sand mold is next rammed around the wax pattern and inside of a sheet iron box, provision being made in the mold for the necessary number of pouring gates, heating gates, and risers. The flame of a torch directed into the heating gate melts the wax pattern and leaves a space around the ends to be welded, into which the thermit steel can be poured.

The heating of the mold with the torch is continuous until the parts to be united have been brought to a red heat. In the meantime, the charge of thermit is placed in a conical shaped crucible supported over the pouring gate of the mold. When the sections are red hot and the mold dried, the application of heat is discontinued, the heating gate plugged up, and the thermit charge in the crucible is ignited. In from 25 to 35 seconds the thermit reaction is completed and the thermit steel is tapped from the bottom of the crucible into the mold, where it flows around and between the sections to be welded, uniting them into one mass.

The initial temperature of 2,800 deg. F. required to start the thermit reaction is obtained by means of an ignition powder. The slag, which is aluminum oxide, overflows into the mold basin, so that it does not interfere with the welding operation. The amount of thermit required for a given weld is determined from the weight of wax in the pattern. Each pound of wax in the pattern calls for 20 lb. of the railroad thermit mixture.

With the thermit process, sections of large size can be welded without the necessity of removing them from their position. This is advantageous in the case of locomotive repairs. It saves taking a broken frame out of the engine in order to weld it, and permits the fusing of a collar or reinforcement of steel all around the welded part in order to increase the cross-section and make it stronger than it was originally. If the weld is in an inaccessible place directly over the pouring gate, a runner should be constructed to lead the steel into the gate of the mold.

Since it is difficult to mix the thermit properly in the crucible, each bag of thermit should be thoroughly mixed beforehand by dumping it into a pan and turning the pile over a number of times before putting it into the crucible. No ignition powder should be added until the thermit charge is ready to be ignited. Occasionally, on account of moisture in the crucible lining or in the thermit, there will be some splashing out of slag in the crucible during the reaction, and it is well, therefore, to see that the risers and all openings other than the pouring gate are covered to prevent this slag from dropping into the mold.

The ignition powder can be ignited directly with a match, but the flare is liable to burn the operator's fingers, and it is, therefore, preferable to use a fuse or an iron rod heated red hot. After pouring, the mold should be allowed to remain in place as long as possible, preferably over night, so as to anneal the steel in the weld. But in case of necessity, it can be removed after two or three hours for a light weld, or in about four hours for heavier welds.

It should be borne in mind that the thermit weld will contract when it cools, and this contraction must be allowed for in advance, either by spreading the parts mechanically with a jack or by heating opposite members so as to spread the part. The molding material should be of a better grade than ordinary molding material. Good silica sand will stand the heat of the thermit reaction, and the weakness of all molding material is the clay binder. Therefore, there should be as little clay as possible in the mixture. The mixture now being used is composed of three parts of clean, sharp silica sand and one part of plastic clay. This material is mixed together with one-fortieth part of Glutrin and sufficient water to bring to the proper consistency.

The thermit process is particularly adapted for heavy welding in the shop, and is also used for rail welding in track work. It is also claimed to be used extensively in marine work for welding broken stern frames, shafts, and propeller struts. In some cases in marine work, where there is more than one fracture, or where there may be considerable defective metal to be replaced, it has been found the best practice to make up a new billet or forging to replace the defective part, and weld this in position.

Abstracted from a compilation of the American Welding Society

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Technical Abstracts

Heat-Treatment Eliminates Wheel Failures

Heat-treatment, which has been used quite extensively for treating car axles by the Twin City Rapid Transit Co., has been developed for the preparation of new rolled-steel car wheels. At present no wheels are being used without the treatment. Prior to the adoption of heat-treatment there had been a certain amount of difficulty through the failures of the steel wheels, particularly during the severe winters that are experienced in Minneapolis and St. Paul. Usually a crack would begin at the periphery, extending to one of the four holes drilled in the web, after which the fracture might extend completely around the wheel unless detected during inspection.

Ordinarily the fractures in untreated steel develop soon after the wheels go in service. They become apparent at once or when the wheels are returned to the shop for truing up after the first 13,000 to 15,000 miles of operation. A few more become apparent after the second dressing at 26,000 to 30,000 miles. If the wheels have not failed at this point there is little likelihood that the cracks will develop before the tread is worn out.

Approximately 1,000 wheels have been treated and at present the first ones have seen 50,000 to 60,000 miles of service. As yet, there has not been a failure of a treated wheel. The rolled-steel wheels when received from the manufacturer are stored in the yard adjacent to the furnace room so that they can be readily rolled in by hand. They are first placed in a furnace, fired with crude oil and heated to a temperature of 1,450 to 1,475 deg. F. This operation takes about two hours.

The wheel is quenched at a temperature of 400 deg. F. in an oil bath, the oil being circulated by a motor-driven pump and cooled in the tank on the roof. Following the quenching the wheels are placed in an annealing oven and the temper is drawn by heating to 1,000 deg. F. This heat is controlled by a recording pyrometer, the operation taking approximately two hours. The heat then is cut off and the wheels are allowed to cool for 15 to 20 hours.

The heating furnace holds a charge of five wheels. Two heats are made in the forenoon and the ten wheels are laid aside. The annealing furnace is opened after the lunch period and the previous day's charge of ten wheels is removed, after which the new charge of ten wheels that were heated and quenched in the morning is placed on a truck and run into it. The ten wheels that have undergone the heat-treatment in the afternoon are placed, after quenching, back into the furnace in which they were heated. The heat remaining in the furnace is sufficient to bring them up to the required temperature for annealing so that additional heating is not required.—*Electric Railway Journal*, July 16.

Heavy Diesel Locomotive for Russia

A heavy Diesel locomotive for service in Russia has been built by the firm of Hohenzollern, A. G., Dusseldorf, Germany. The locomotive has a total weight of 288,900 lb., and the Diesel engine develops 1,100 hp. at 400 r.p.m., or 800 hp. at 300 r.p.m. The locomotive is of the 4-10-2 type. The motor is four cycle, has six cylinders, and is reversible. It is water-cooled. The pistons are oil-cooled, and the locomotive is equipped with a large-capacity oil cooler. A new feature of the locomotive is the heavy electromagnetic clutch.—N. Dobrowolski, *V.D.I.*, Berlin, June 18.

Education for the Industries

In order to fulfill present industrial requirements, several distinct types of educational training are required. First, there is a need for general education among the masses; for instance, groups of employees in the industry need more detailed information regarding business conditions, marketing problems, manufacturing costs and the like. Second, there is need for more complete and thorough job training. Third, there is a vital need for foreman training, and finally there is a need for men of definite qualifications supplied by formal education. This last field is divided into three parts. In the first the function of leadership is paramount. The second group is hardly distinguishable from the first and is made up of highly-developed engineers or specialists broadly trained in scientific fundamentals. The third classification is that in which the service requirement is of a routine nature although based on a type of training secured through educational processes of collegiate grade.

The question arises shall men for this last group of work be recruited from the ranks of those who have failed to make the higher grade or from a group specially trained for this type of work? The author suggests the selection of men for various classes of education on the basis of ability. He feels, however, that we have not reached the point where individuals are ready to commit themselves to the guidance of such a distinctly selective process and that the natural results would be that the secondary curriculum would become merely the resting place for those who have failed. Hence a segregated institution with a short curriculum and a less expensive scheme of education is suggested. This should be co-ordinated with a highly scientific institution in its neighborhood, and men of unusual ability could be passed on, should their financial condition permit. The training should be conducted along an educational plan based on collegiate grade training in mathematics and physical science, but should not be carried to the higher levels as in the professional schools. They should include the basis of a liberal training, limited only by the time element.—P. F. Walker, *Mechanical Engineering*, August.

Overlooked Factors in Plant Location

To the average business the three items of greatest importance in choosing a plant location are markets, raw materials, and labor supply. Transportation is important in most industries. Even some of these important factors are sometimes not checked, particularly when branch plants are established, the assumption apparently being that conditions will be the same in the new location as in the old one. Climatic conditions are vital to such industries as photographic supplies and textiles. Power and fuel are relatively more important than most managers consider them, and their cost will continue to mount as more power is used by industry. A good labor supply is vital and can usually be found along the trunk-line railroads. Shoe manufacturers and textile men have found it profitable to establish branch plants in places where the wives and daughters of laborers and artisans in other plants can be depended upon. There is a distinct trend today toward moving branch plants to more advantageous locations. It is worth watching, for the company that chooses its location after a scientific study of all the factors involved will have a big competitive advantage.—W. M. Booth in *The Magazine of Business*, July.

Fixed and Flexible Idlers on Leather-Belt Drive

The two most commonly used types of idlers for belt drives are the fixed and the flexible, or gravity idlers. The fixed idler is suited only to those drives on which the small pulley is the driven pulley and the load is more or less steady, that is, does not fluctuate. The average generator drive is an example of such a load. In these cases the idler should always be placed as close as possible to the smaller driven pulley and on the slack side of the belt. Its location should be such as to make the wrap or arc of contact on the small pulley approximately 225 to 245 deg. When the idler is in this position, the belt can be run fairly slack. The tension on the small pulley, however, is maintained by the checking effort of the idler on the

belt as the belt bends around the idler. On such drives it is necessary to use a belt amply wide, for the load it is to transmit and the diameter of the small pulley must be in proportion to the load transmitted over it.

The most common type of adjustable idler and the one best suited for all conditions is the flexible idler typified by the Lenix and Pulmax drives and other similar units. These consist of a pulley mounted on a swinging and weighted arm which can be set to give a direct tension, but is self adjusting to meet load variation. Flexible idlers should always be located next to the small pulley regardless of whether it is driving or driven, and on the slack side of the belt. The clearance between the faces of the two pulleys should not be more than 1 to 1½ in. when they are in their closest position. Never place a flexible idler midway between the two pulleys or next to the larger pulley if it can be avoided. When either the fixed or flexible idler is placed midway between the two pulleys it makes a drive that is nothing more than a good belt stretcher because the idler can move through a considerable distance and take up only a small percentage of the stretch in the belt.—By Roy C. Moose, *Industrial Engineer,* July, 1927.

Guarding Patentable Ideas

The moment an idea is conceived it is of great value to make a simple sketch, properly dated, and have it witnessed by someone who will sign it. It is not necessary that the witness understand the function of the invention or idea pictured by the drawing. It is sufficient that he sign his name on the sketch as witness to the effect that it was made on a certain date.—James McIntosh, *Machinery,* June.

Aluminum Bronze

The aluminum bronzes are aluminum copper alloys rich in copper, and have been known for a number of years, but their extensive commercial application has been of recent origin and at present is growing at a high rate. Aluminum bronzes comprise a group of copper-rich aluminum copper alloys containing up to about 16 per cent of aluminum by weight with or without addition of other metals. Other elements sometimes included are manganese, iron, nickel, and zinc. In no case, however, are the alloys considered as aluminum bronzes when they contain more than 25 per cent of elements other than the two basic ones.

The alloys can be cast, forged, hot rolled, or cold rolled. Alloys of from 5 to 7 per cent aluminum, with and without iron or manganese or nickel, have been put through pressing and drawing operations, using the same die equipment as employed for brass. They have high tensile strength. An alloy of 88 per cent copper, 7 per cent aluminum, 3 of iron, and 2 of manganese gave a tensile strength of 74,000 lb. per sq.in., and an elongation of 42 per cent in 2 in.

The aluminum bronzes machine quite differently from other non-ferrous alloys. They are quite hard and are very severe upon cutting tools, due to the abrasive action of the aluminum oxide present. For most cutting, the usual high rake angles of tools for non-ferrous metal cutting appear to be unsuitable. Lower rake angles on the tools than those used for steel have proven effective. When the alloys contain not more than 5 per cent of aluminum, they can be soldered without difficulty, using ordinary lead-tin solder. But with higher aluminum content trouble arises, due to the persistent rapid formation of a film of aluminum oxide on the surface of the metal. Brazing is done satisfactorily with copper-zinc-tin solder, and welding of the alloys is accomplished with a welding rod of aluminum bronze containing some manganese.—*Transactions, A.S.S.T.,* July, 1927.

Largest All-Metal Bombing Plane

What is claimed to be the largest all-metal bombing plane ever built in the United States was recently turned over to the Army Air Corps by the Curtiss Airplane & Motor Co., of Garden City, L. I. The plane is known as the "Condor (XB-2)" and is a biplane equipped with two Curtiss 600-hp. geared engines. Due to the efficiency of the propeller being increased by the gearing, the plane takes off in a comparatively short distance and climbs rapidly. It has an estimated high speed of 120 m.p.h., and a cruising radius of 800 mi. at approximately 100 m.p.h. It carries a crew of five men, one pilot, one bomber and three machine gunners. One gunner is located in the nose of the machine, and the other two behind the lower wing and beside the fuselage behind the engines. These locations enable them to cover attacks of hostile aircraft from any direction.

The entire framework is of metal with a fabric wing cover. The fuselage, tail and wing ribs are of duralumin while the wing beams, motor mounting, bomb bay and other highly stressed parts are of alloy steel. The entire wing beam is of welded, heat treated, chrome molybdenum steel, being built of two flattened tubes with welded into-bracing forming a warren truss. The ribs are built up of riveted duralumin. The engines develop 600 hp. each at 2400 r.p.m but the propellers are geared down to 1200 r.p.m. Owing to this low speed and high power, two Curtiss-Reed propellers of 14 ft. dia. and weighing 220 lb. each are used. They are the largest propellers of this type yet built.

Behind each engine is a fuel tank carrying 190 gal. This, together with the arrangement for carrying the bombs, places all the extra weight directly in line with the center of gravity so that the longitudinal stability of the plane is not affected by a difference in the fuel or bomb load carried. In addition to these two tanks there is a gravity tank in the upper wing directly above the fuselage.

It is of interest to note that the empty weight of the plane is 9020 lb. or 40 lb. less than that originally calculated. To carry the weight of a fully loaded plane, the landing wheels are 54 in. in dia. and are capable of carrying four tons each. They are provided with hydraulic steel brakes developed by Curtiss engineers in co-operation with the Lockheed organization. The brakes may be applied independently so as to aid manoeuverability on the ground. The wing span is 90 ft., the chord 9 ft., the length over all 47 ft. 5½ in., and the height 16 ft. 6 in. The total weight with fuel and bombs is 16,300 lb. The rate of flying is 860 ft. per minute at sea level, and the ceiling is 14,000 ft.—*Aviation,* July 25, 1927.

Obsolescence in Mill Machinery

Obsolescence in individual machines can be analyzed from two viewpoints: First, a machine is obsolete when worn out; second, a machine is obsolete when it cannot produce what the market demands. The only argument about the first instance is just when a machine is worn out. This involves the question of fixing or repairing. When the adjusting and repairing have to be repeated too frequently, it indicates that the machine is obsolete. When a repairman must spend above a certain amount of time on a machine which at the same time is non-productive and which has just previously been producing poor work, it costs too much to operate that machine for the percentage of time it does run. It should be kept in mind in connection with repairing that one very important item is the amount of time any machine is stopped. The object of a mill is to produce, and not to be a machine shop. Mill machine shops are necessary to repair machines and fit parts, but the tail should not be allowed to wag the dog, and the machine shop should not make parts that can be bought of the machinery builders.

When a machine cannot produce what the market wants may be an absolute or a relative condition. There are some machines which can produce the new market requirements by changing some of the parts or by attaching new parts. But with these machines there always arises the question as to when to buy attachments and when to buy new machines. There is always the question of how long it will be before there is a new development that will make today's machines of little value. And the way of guarding against this sort of calamity is to charge off a large percentage of the machine costs during the first year. This can be applied to textile machinery, as well as to automobiles. For the first year, almost any machine, with reasonable care, will run at high efficiency with almost no repairs. As it ages, it requires more and more attention, and the less it is worth. If 40 per cent is charged off each year, this leaves the machine worth 60, 36, 22 and 13 per cent of the original cost at the end of the first four years, respectively. Perhaps this is too short a time for some machines, but the principle will apply regardless.—Gilbert R. Merrill, *Textile World,* July 23.

American Machinist

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Rationalization

RATIONALIZATION, or the German word of which it is the equivalent, is a word to conjure by in Germany. Some idea of what it means to have a whole nation working toward one objective may be gained from several articles by Edward J. Mehren that have appeared in the *American Machinist* within the last few weeks. No explanation of its meaning is necessary here.

The point is that the movement will bear watching. Some of its component parts have counterparts in the United States but there has not been anything to correspond to a unified movement supported by practically a whole people. If Americans can learn something by watching its development, something that they can emulate to advantage, well and good. If it appears likely that its success will permit Germany to produce better quality at less cost it is all the more worth watching.

Standardized Electric Motors

FOR years there has been a conflict between the builders and users of electric motors over the possibility of designing motors for interchangeability in mounting. In other words, with standardized overall dimensions, shaft heights and bolt hole spacing. The users have insisted that such standardization was as possible as it was desirable. The builders have maintained that it was not commercially possible.

Now comes an announcement by the British Thompson-Houston Co. Ltd., of a line of interchangeable A.C. and D.C. motors from ½ to 40 horsepower. Evidently the claims of the American motor builders have not been entirely ingenuous or else their British contemporaries are better designers. At any rate they will have some difficult explaining to do the next time the subject comes up.

Paying for "Know-How"

SETTING a commercial value on knowledge is very difficult because it is not a staple commodity, as is iron or other tangible material. As a result, knowledge—or "know-how" to put it in shop language, is seldom adequately paid.

We may easily spoil a thousand dollars worth of work by improper handling in the hardening bath. Yet how many of us would willingly pay a thousand dollars for five or ten minutes of an expert's time, even if he told us just where we made the mistake? We would be very apt to consider only the fact that he had demanded a thousand dollars for ten minutes of his time. We would forget entirely, that behind the ten minutes were days and years of hard work, and many failures, before he acquired the knowledge that enabled him to set us right, and would figure only that he had charged us a hundred dollars a minute.

Until we can bring ourselves to rate "value received" in other than terms of material substances, "know-how" will continue to be underpaid.

Ship to Shore

ANOTHER chapter in the development of commercial aviation was written when Clarence Chamberlin rolled off the improvised hundred-foot runway above the Leviathan's bridge, cut a few joyful aerial capers above the big liner and her attendant destroyers, and came down at Curtiss Field shortly after because of low visibility. The interesting point is that he delivered his letters hours before the fast destroyers got back to New York harbor.

Supplemental service such as this can be developed much more rapidly than transoceanic passenger carrying. When permanent arrangements have been made there will probably be many instances where it can be employed to advantage. Many a race with death might have been won had it been possible to cut a day or more from the length of the sea trip. Late mail can overtake a liner well out from shore—a late passenger or two, as well. Storm delays that would otherwise prevent business men from keeping important appointments can be offset by airplane service.

Probably the makeshift arrangement of a temporary wooden platform as used by Chamberlin will give way to a much more practical and efficient device, perhaps the Navy-type catapult. It would also seem desirable to use either a seaplane or an amphibian so that an overtaking plane could come down in the water and be lifted aboard by crane. The catapult, the amphibian and the seaplane are long past the experimental stage. Consequently this form of aviation awaits only the working out of equitable rates for the service.

Shop Equipment News

Hammond High-Speed Automatic Tapping Machines

THE Hammond Manufacturing Co., Cleveland, Ohio, has designed a line of automatic tapping machines to perform drilling, tapping, stud, nut- and screw-driving operations with a minimum of effort on the part of the operator. The hinged arm feature of the Hammond radial drilling and tapping machines has been retained as it is claimed that this construction has been proven to be the fastest type of radial construction for light, short operations. The design permits the operator to move the spindle from one position to another with a single, straight-line motion.

The machines are furnished on a column with a full size T-slotted base as shown in Fig. 1, in a wall type, and also in a pedestal type as shown in Fig. 2. Fig. 3 shows the mechanism for driving and reversing the spindle. A double cone friction is held down in contact with the driving pulley or up in contact with the reversing pulley by the automatic control mechanism.

In Fig. 3 the control mechanism is shown in the reversing position. In tapping to a predetermined depth the reverse motion is obtained by collar *A* coming in contact with the stop nuts on the screw *B* connected to lever *C*, which in turn trips the latch *D* and allows the spring-actuated bolt *E* to move the bell-crank lever *F* forward to raise the double cone friction into reversing position. In tapping to the bottom of a blind hole or driving studs with a plain threaded driver, when resistance to turning overcomes the driving power of the angular faces of the clutch *G*, the upper clutch member separates from the lower and, through lever *H*, trips latch *D* and reverses the spindle.

When driving nuts or cap screws the stop screw *K* is set to stop the lever *F* when the driving frictions are in a neutral position, thereby stopping the spindle when the nut or cap screw is as tight as desired.

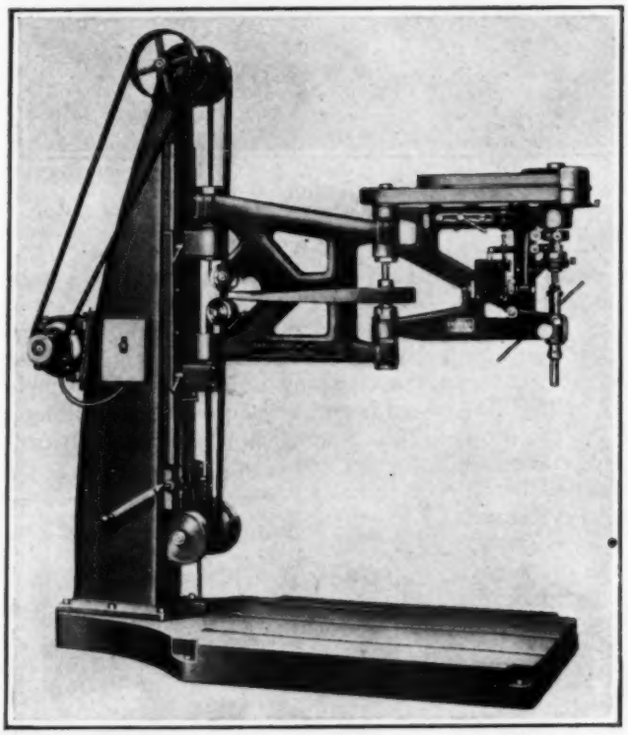


Fig. 1—Hammond High-Speed Automatic Tapping Machine, Radial Type

In the radial units, the countershaft is integral with the machine and may be driven through a friction clutch or from a self-contained motor. Both the upper and lower countershafts are fitted with Hyatt "High-Duty" roller bearings suitably inclosed to exclude dirt and provided with ample oil reservoirs. The idlers, vertical shaft and spindle pulleys are fitted with Fafnir annular ball bearings, fully inclosed.

The pedestal type of automatic tapping machines has the same spindle driving and reversing mechanism as the radial machines and can be furnished with either self-contained motor drive as shown or with a clutch pulley mounted on the countershaft.

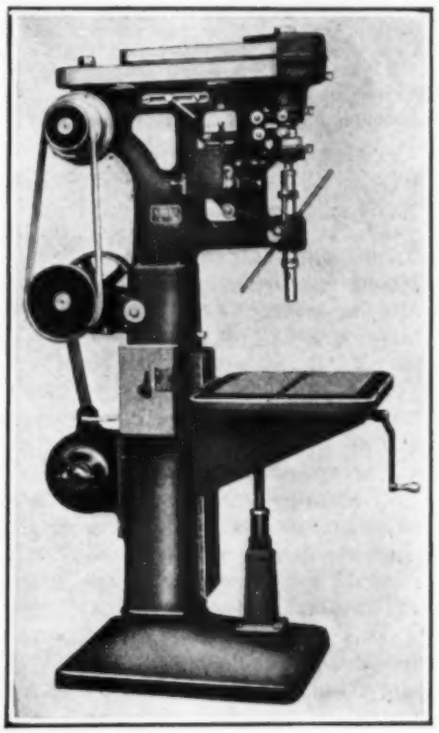


Fig. 2—Pedestal-Type Automatic Tapper

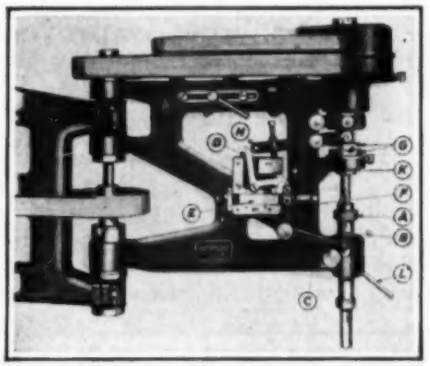


Fig. 3—Automatic control mechanism

The drive pulley shown on the top of the head at the rear is mounted on a vertical shaft driven through spiral bevel gears running in oil. The horizontal and vertical shafts, idlers and spindle pulleys are mounted on Fafnir annular ball bearings, while Hyatt bearings carry the countershaft.

SPECIFICATIONS OF RADIAL TYPES

Drilling radius, in.	48
Minimum distance spindle to column, in.	12

Shop Equipment News

Vertical adjustment of saddle on column, in.	24
Traverse of spindle, in.	5
Working surface of base, in.	34x48
Spindle speeds, r.p.m.	290-625-1,000
Capacity in cast iron, in. drills	$\frac{3}{4}$
taps	$\frac{1}{2}$
studs	$\frac{7}{16}$
Shipping weight, lb.	2,500

SPECIFICATIONS OF PEDESTAL TYPE

Working surface of table, in.	16x20
Maximum distance end of spindle to table, in.	19
Vertical adjustment of table, in.	14
Spindle traverse, in.	5
Shipping weight, lb.	1,000

American Swiss File Co.'s Small Tools

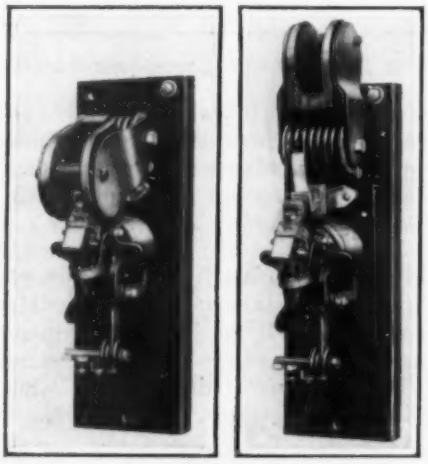
The American Swiss File & Tool Co., Elizabeth, N. J., recently took over and is now manufacturing the complete line of small tools formerly made by the Braunsdorf-Mueller Co., of Elizabeth.

This line includes knurl sets and holders, plumb bobs, cold chisels of all kinds, stone drills, socket wrenches, bearing scrapers, and several styles of punches, besides a miscellaneous lot of small tools.

Cutler-Hammer Improved D. C. Mill-Type Contactor

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has equipped their d.c. mill contactors with an improved design of magnetic blowout. The design was perfected after considerable research in determining the effect of the shape and the material used in the contacts themselves, the shape and material of the arcing tips, the location and intensity of the magnetic blowouts, and the material used for the blowout shields.

In actual test, a 300-amp. butt-contactor made and broke a 600-amp., 250-volt circuit, an average of 263,000 operations for each set of contacts. The improved design is said to reduce maintenance and inspection costs, since the contacts and blowout shields will not need to be renewed as frequently as before.



Cutler-Hammer Improved D.C. Mill-Type Contactor

Wickes 34-Inch Semi-Automatic Crankshaft Lathe

THIS 34-in. semi-automatic crankshaft lathe has been arranged by Wickes Brothers, Saginaw, Mich., to hold the crankshaft on anti-friction live centers and to drive from the center bearing, which should be previously machined. The drive is through a herringbone gear, which is securely clamped to the center bearing. The lathe cheeks, turns and fillets the front bearings, the front end of the crank, the rear bearings, oil grooves and flange. In Fig. 1 the machine is shown set up for finishing a 3-bearing, 6-throw crankshaft. The machine can also be tooled for a heavy 5-bearing, 8-throw crankshaft, as shown in Fig. 2. The cross slides are arranged so that the tooling can easily be changed for machining different cranks in the same lathe.

The machine follows the general design of the Wickes semi-automatic crankshaft lathe used for pin turning, which has been on the market for several years. The present lathe is equipped with power feed, a quick change gear box, automatic split feed, automatic feed stops, and an automatic accelerating device to the crankshaft so that the lineal cutting speed of the tool bit remains constant as the tool advances to the center of the work. The drive is through a silent chain from a 15- to 20-hp. motor mounted on the headstock.

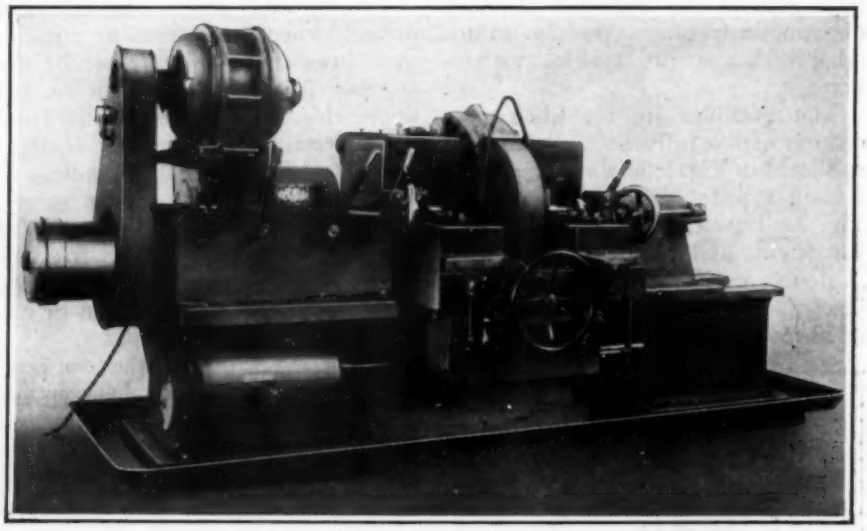


Fig. 1—Wickes 34-Inch Semi-Automatic Crankshaft Lathe with center drive

The arrangement of the herringbone gear and the centers is such that the chucking of the crank is simple and is said to require only one minute. This type of lathe gives a high production and is said to do in one oper-

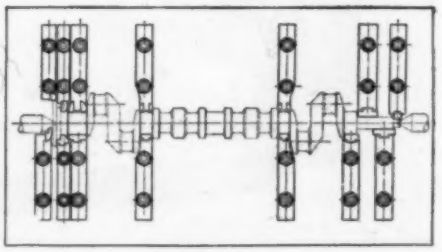


Fig. 2—Tool set up for machining a 5-bearing, 8-throw crankshaft

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ation what previously required from four to six operations.

The rear tools are carried on inverted cross slides which are mounted in a housing securely bolted to the bed. This arrangement of the tools permits ready clearance of the chips and cooling compound. The cross slides are equipped with the Wickes patented electric rapid cross traverse for quickly advancing the tools to the cutting position, and after the operation is complete, withdrawing them to the unloading position.

The approximate weight of the machine is 17,500 lbs.

Traversing-Rail Type Way Grinding Machine

IN THIS type of way grinder, the work is held stationary and the grinder heads are traversed on rails along the ways to be finished. The machine was developed by Schmirgelwerk Dr. Rud. Schoenherr, Germany. The agent in this country is L. Sichel, Room 740, 200 Fifth Ave., New York, N. Y. A common foundation platen is provided cast integral with which are taper bosses on which the wedges that serve to align the bed are made to slide. These wedges are spaced at such intervals as to afford an easy and sensitive adjustment to level the machine. The bed is a heavy casting of box form, strongly braced, and is said to be of such liberal section as to make deflection negligible. It has one flat and one V way on which the column is made to slide.

The double radial arm carrying the grinding heads slides vertically on a heavy rectangular column by means of adjustable ball bearings of special design running on steel ways in the casting. This column may be turned in a full circle on its cast-iron base. The radial arm can be elevated either by hand or by power or fed to the work by micrometer screw. It is counterbalanced by a self-acting hydraulic pressure device, which eliminates all play and permits feeds within 0.0001 in. while adjusting the tool to grinding height. The radial arm casting is strongly ribbed with the result that deflection is reduced to a minimum even with full load while the heads are in extreme position.

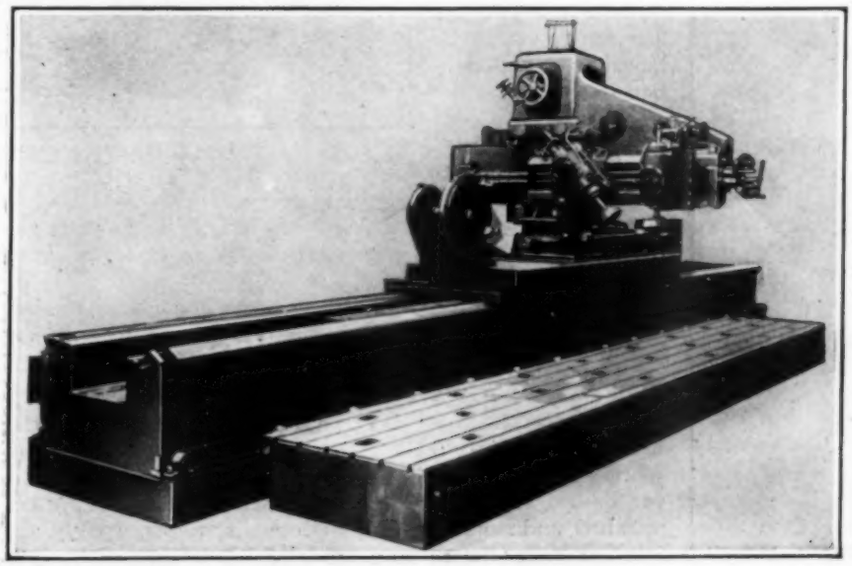
One arm of the radial is furnished with two independent grinding heads powered by 1¼-hp. built-in motors. These motors have dynamically balanced rotors and are adopted for the reception of either cup or saucer wheels on either spindle end. The combined armature spindles rotate in ball bearings of special design. Each motor unit is mounted on a complete compound slide to allow adjustment for height along the rail and swiveling within a full circle for the finishing of flats, Vs and dovetails at any desired angle. In order to provide accurate re-setting of angles for interchangeable manufacture, both heads are furnished with a number of sensitive spirit levels for use in setting the heads to the desired angles. Micro adjustments on all feeds also aid in setting the head to close limits. The universal heads accommodate wheels up to 10 in. in diameter.

For dealing with wide flats on saddles and slides, a segment wheel head is furnished on the other radial arm. This wheel is also direct-connected to its driving motor spindle. The head is set vertical and when swung into the working position will finish wide flats parallel with the ways finished by means of the smaller head. The segment wheel head is fitted with independent automatic lubrication by means of a pump driven from the spindle. An accurate stop is provided for bringing either side of arm into the correct working position.

The column with the radial arm is reciprocated on the bed by means of a magnetic clutch in conjunction with tripping dogs that can be set for the desired stroke on a special control disk. Several traversing speeds are available through a gear box or electrical control. In the machine illustrated, d.c. motors are used and rheostat control provides a wide range of column traverse or grinding feeds. Push-button control is used.

The cast-iron base, which travels on the bed ways, forms a platform upon which the operator can conveniently ride and from which all levers and hand wheels are reached. The work is held stationary on the platen or front of the bed.

The bed for reciprocating the column is furnished with a length commensurate with the work in hand. The machine illustrated has a bed length of 29 ft. and a grinding length of 20 ft., and is said to be accurate within 0.0004 in. The machine may be driven by either a.c. or d.c. motors, but d.c. is recommended because of its increased flexibility of control.



Traversing-Rail Type Way Grinding Machine

"Chapnuts"

The National Nut & Bolt Co., North Easton, Mass., has placed on the market a type of self-locking nut that it is claimed will withstand any amount of vibration without working

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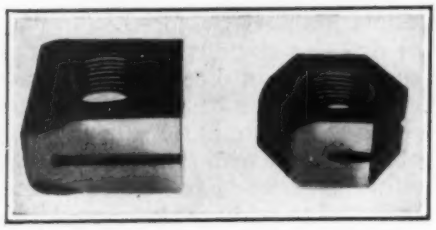


Square and Hexagon "Chapnuts"

loose. The nut is made in all commercial sizes from $\frac{3}{16}$ to $\frac{3}{4}$ in., both square and hexagon, and may be furnished black, polished, nickeled, galvanized or case-hardened. Larger sizes will be produced.

The nuts are made of a specially selected steel. To make the square nut a piece of suitable length is cut from the strip of stock and folded upon itself to leave a space between the two leaves equal to about one-eighth of the thickness of the nut. The hexagon nuts are made from the same stock in the same way by notching the sides of the strip before cutting it off, so that when folded the blank will assume the desired hexagon shape.

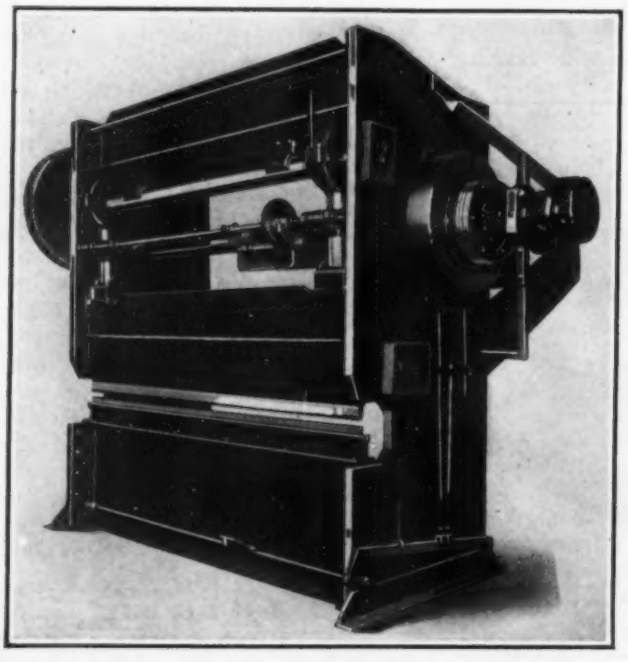
The operations of notching, cutting off and folding are performed simultaneously in a progressive die, which also swages the blank in the direction of the fold to make the distance across the flats uniform in this direction in all nuts of a given size. Following operations, conducted in separate tools, swage the blanks in the remaining one or two dimensions as the case may be. The blanks are then drilled and tapped.

The final operation upon the nut is to strike it a blow under a small press to effect a partial closing of the space between the leaves and thus throw the two parts of the tapped hole slightly out of alignment with each other. When the nut is screwed upon a bolt and the leaves thereby forced again into alignment against the resiliency of the metal a condition is set up which, it is claimed, will effectively resist any tendency of the nut to back off the thread.

Dreis & Krump Steel Forming Presses

THE Dreis & Krump Manufacturing Co., Chicago, Ill., announces the addition to its line of a series of all-steel forming presses of the single-housing type. These have been designed for the production of light work, and the makers cite their convenience of operation and low cost.

The presses are rigidly constructed throughout, with the housings, ram and bed made of steel plate to prevent breakage. The gears are also made of steel, and the eccentric strap, knuckle bearings and gibs for the slides are semi-steel castings. The eccentrics themselves are forged steel, keyed to a high-carbon steel shaft. The connecting screws are also of carbon-steel forgings.



Dreis & Krump Steel Forming Press

These presses require no foundation or pit, but are set level on the floor and are shipped completely assembled.

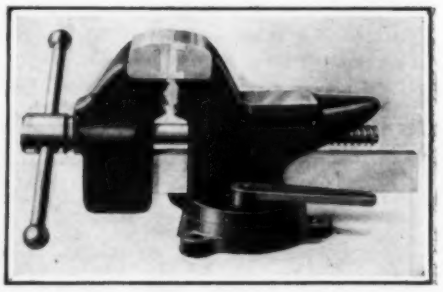
All bearings are of ample size, and are said to be accurately fitted and grooved wheel has a clutch for oiling. The fly- attached, and runs on Timken roller bearings. The outboard flywheel bearing is also a self-aligning Timken bearing. The clutch is of the multiple-disk type, having asbestos friction blocks, and is engaged by a treadle adjustable to any position on the full length of the machine. The clutch incorporates a friction brake that stops the ram instantly at any desired position when the treadle is released.

Sight force feed oilers provide automatic lubrication to the eccentrics, bearings and slides. Adjustment of the ram is obtainable by an independent motor controlled by a reversing switch. An Allis-Chalmers Texrope drive connects the motor direct to the flywheel.

Simplex No. 3½ Utility Vise

The Simplex Tool Co., Woonsocket, R. I., has placed on the market the No. 3½ utility swivel vise shown in the illustration. The unit also combines a pipe vise and an anvil. The jaws are 3¾ in. wide and have hardened steel inserts which are easily removable. The anvil is provided with a horn for particular use with round pieces or rings and hoops.

The movable jaw is actuated by a special steel, square-thread screw. The slide is made of steel and is said to be unbreakable. It is accurately fitted, and it is said that no wobble takes place. The swivel base design enables the vise to be locked in any position.



Simplex No. 3½ Utility Vise

The maximum opening of the jaws is 4½ in. and the weight of the unit is 18 lb. net.

Milburn Extension Paint Spray Equipment

Of particular use in painting ceilings, high walls, tanks, freight cars and other high surfaces without the use of a large number of ladders or

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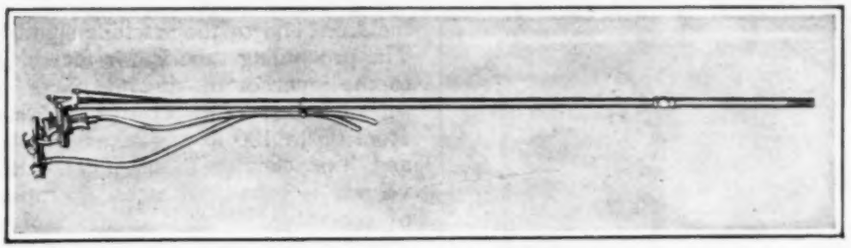

Milburn Extension Paint Spray Unit

scaffolding, the Alexander Milburn Co., 1416 W. Baltimore St., Baltimore, Md., has developed the paint spray extension equipment shown in the illustration. It grips the standard Milburn paint gun.

The extension is 8 ft. in length and it is claimed that the operator can reach a height of 14 ft. with his own reach. Any length of extension can be furnished upon specification. For painting within arm's length, the gun is immediately detachable and can be used as a hand spray.

A slight pull on the operating handle of the extension moves the air and paint valves of the spray gun simultaneously. The regular unit consists of the extension and standard Milburn Type E gun, a pressure feed tank with regulators, and 25 ft. of air and paint hose with connections from the compressor to the pressure container.

The extension is ruggedly constructed of strong tubing and has the valve and angle controls close to the bottom for easy manipulation of the spray. It is claimed to be light in weight and well-balanced.

Milwaukee Improved Nos. 2 and 3 Milling Machines

FRONT dial feed control has been added to the Milwaukee Nos. 2 and 3 standard milling machines made by Kearney & Trecker Corporation, Milwaukee, Wis. A typical machine is shown in Fig. 1, while Fig. 2 plainly shows the dial feed device. By means of a single crank lever and direct reading dial, it is possible to instantly secure eighteen changes of feed, when the machine is either running or standing idle.

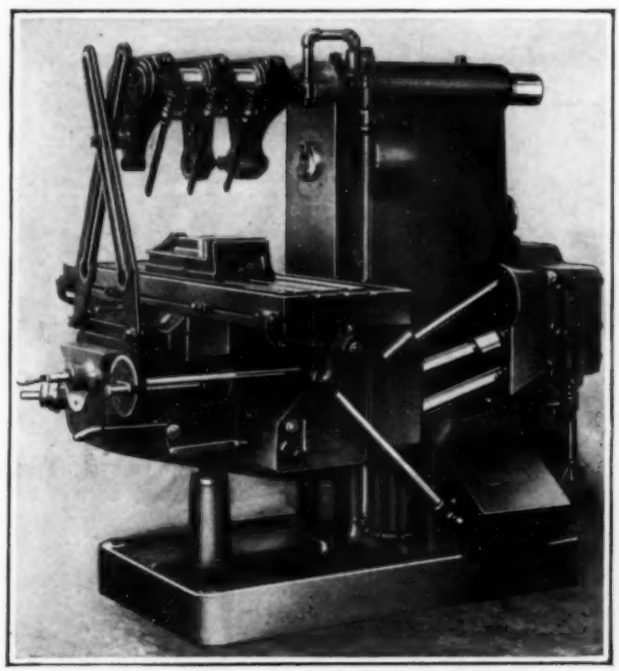

Fig. 1—Milwaukee No. 3 Improved Standard Milling Machine

The feed box is located at the rear of the column, and is of the sliding gear, selective type. All gears are made of tough alloy steel, heat-treated. The entire box is automatically lubricated by the same pump that lubricates the inside of the column. The dial with the numerals on it revolves with the crank-handle which is mounted on the end of a universal jointed shaft passing along the right side of the column. The outer rim, on the inner portion on which is mounted the arrow, remains stationary. There are two holes, 180 deg. apart, into which a plunger engages. One half a revolution of the crank is sufficient to change the feed. The crank is turned in either direction until the feed desired is opposite the arrow. By releasing the spring plunger, the crank is locked in place.

Since the rotary dial is direct reading, there is no chart or table to study out and the operator can tell at a glance the feed being used. By placing the feed box at the rear, the manufacturers claim it can be made larger and more powerful and that its lubrication can be taken care of in a simpler manner than if it were mounted upon the knee. All the principal shafts in the feed box are mounted upon New Departure ball bearings.

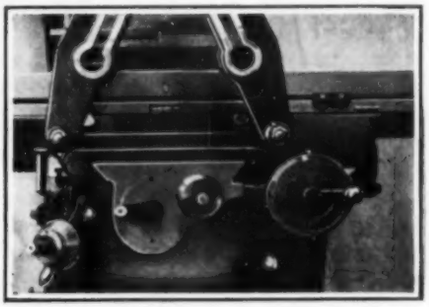

Fig. 2—Dial feed control

In other respects the machines are standard and include power rapid traverse, Timken roller bearings and a low pressure cooling system.

Clark Steel Trailer with Rubber-Tired Wheels

A steel trailer with rubber-tired wheels, and fitted with an automatic coupler, has just been placed on the market by the Clark Tructractor Co., Battle Creek, Mich. These distinctive features are said to insure safety of loads and speed of operation.

The trailer is of the standard warehouse and shop size. It has a diamond-plate steel platform 3x6 ft., and the top is 14 in. from the ground. The body is formed by a single piece of ¼-in. steel. The design is said to provide a body and frame of exceptional strength and rigidity, while the diamond impressions prevent the load from slipping. The adjustable racks are interchangeable for use on either the ends or the sides.

The two casters at the front are of

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Clark design and swivel on eighteen 1-in. steel balls with a Timken bearing in the kingpin location. The wheels themselves are mounted on high-grade solid-roller type bearings of special design. All bearings are equipped with Alemite fittings. Rubber tires are furnished on all four wheels. The rear tires are 12x4 in., and the caster tires 10x3 in. The weight of the complete trailer is 550 pounds.

Fig. 1—Clark Steel Trailer with Rubber Tires

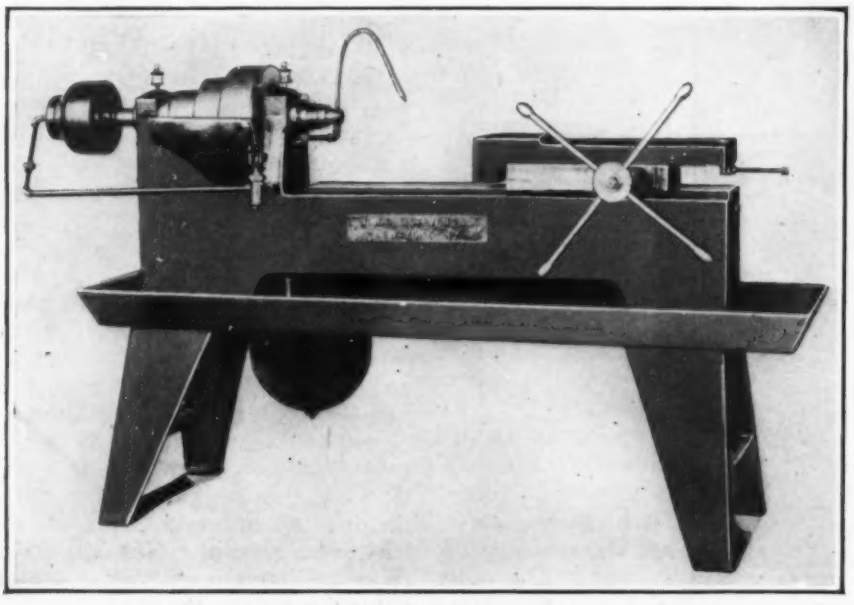
Claims made for this trailer are that it eliminates all noise, prevents wear and tear on expensive flooring, pavements and platforms; reduces breakage to a minimum and enables tractors to haul larger loads and longer trains. The trailer may be coupled and uncoupled from the tractor without the driver dismounting. The rubber tires also eliminate sparks in paint and varnish shops when traveling on concrete floors.

Stevens No. 2½ Air-Operated Chucking Machine

THE No. 2½ air-operated chucking machine was recently placed on the market by John B. Stevens, Inc., 27 Cleveland Place, New York, N. Y. The machine is shown equipped with a plain slide but a regular six-hole improved hexagon turret with slide and base can be furnished in its place. A pan, pump and piping are regularly furnished. The machine has a double friction countershaft and is driven by a 3½ in. belt.

The machine is designed to operate wrenchless chucks, collets and expanding mandrels of the drawback type, which can be readily fitted to the front end of the machine spindle. The protruding tube is for attaching to the inner or moving members of such devices. Air pressure ranging from 65 to 100 lb. per sq.in. is used and it is claimed that a very small volume is exhausted at an operation of the valve. This head mechanism was designed to shorten the "in and out" time for chucking work. A turn of the valve causes the spindle to stop instantly, and the chuck jaws to open. After the next piece of work has been inserted, a turn of the valve causes the chuck jaws to grip instantly and the spindle to revolve. It is claimed that in this way several movements of the operator are eliminated and the time of set-up thereby shortened.

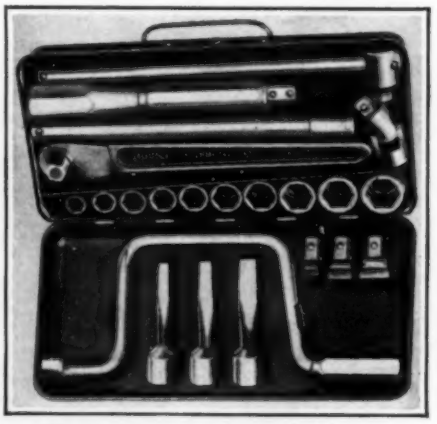
The spindle is hardened and ground and runs in large bronze bearings. A multiple-disk clutch stops rotation of the spindle while drive is effected through a wide-face, cone-type clutch mounted on the large cone step.



Stevens No. 2½ Air-Operated Chucking Machine

Husky No. 190 Utility Wrench Set

The No. 190 utility wrench set has been added to the line of socket wrenches made by the Husky Wrench Co., Milwaukee, Wis. This set has a complete range of socket wrenches



Husky No. 190 Utility Socket Wrench Set

plus three socket screw drivers, three sizes of screw-driver bits and a special screw-driver handle with swivel grips. The set is packed in a compact, black-enameled metal box as illustrated.

All units are heat-treated and nickel-plated. The set is intended for automotive and industrial maintenance and repair work.

NEWS OF THE WEEK

Half-Million Dollar Order for South American Machine Shop

Much interest was created in machinery circles in the New York market last week by the announcement that the Niles-Bement-Pond Co. had received an order for machine tools which totaled well over a half million dollars. The order came from the Sorocobana Ry., in Brazil, and was for equipment for the company's central repair shops at Sorocobo, in the State of Sao Paulo, Brazil.

The installation of this machinery will mark the completion of what is said to be the most modern machine shop in South America, and the order itself is probably the largest placed by any foreign purchaser in the United States since 1921. It is the opinion of many leaders in the New York market that this order marks only the beginning of some extensive re-equipment programs in many South American countries. It is definitely known that other large orders are in prospect.

Reduced List of Ball Bearings

To encourage the use of fewer sizes of radial ball bearings, the standards department of the Society of Automotive Engineers about a year ago listed the sizes that were used more extensively by motor vehicle manufacturers. Since then, several bearings manufacturers have printed the reduced list in their catalogs and at a recent meeting of representatives of the manufacturers it was agreed that it would be helpful to republish the list and bring it to the attention of the automotive industry in general.

This has been done in the July issue of *The Journal* of the society and in the current issue of the *S.A.E. Handbook.*

International Cartels Fail in Europe

The movement toward the establishment of cartels among national groups within similar industries or branches of industries which has characterized European metallurgy during the past few years has not been entirely successful, says a report made public by the Department of Commerce. Notable examples of the failure of these projects are to be found in the cartel of metal grating manufacturers and in the European wood screw entente.

The metal grating cartel, composed of German, Belgian, English and French manufacturers, established on July 10, 1926, is to be dissolved on Sept. 30, 1927. The German participants attribute the dissolution to the refusal of the British members to give up their tariff preference within their own colonies, while the British members were reported to object to its continuance because of the non-adherance of Austrian, Czechoslovak and a number of small German producers.

The wood screw entente, which has had its central office at Luxemburg, has been dissolved recently, the result, it is said in Paris, of competition in the export markets by French and Belgian producers who declined to be bound by the prices proposed by the German members.

Machine Shop Practice Papers for New Haven

The first national meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers will be held at New Haven on Sept. 7 to 9, during the period of the seventh annual machine tool exhibit which is to be held in the Mason Laboratory, Yale University.

A three-day program has been arranged by the committee, several papers to be presented on each day. These papers are announced as follows: "Economics of Machine Tool Replacement," by Myron Curtis; "Advantages of Up-to-Date Machine Equipment," by L. C. Morrow, managing editor, *American Machinist;* "Modern Finishes for the Machine Tool Industry," by W. R. Atwood; "Fundamentals of Polishing," by Bradford H. Divine; "Education for Foremanship," by James A. Moyer. Another paper on foreman training will be presented at this session by C. H. Klinefelter. At the final session the papers will be: "Improvements in Copper Wire Mill Equipment," by Samuel McMuellen; "Recent Developments in the Application of Anti-Friction Bearings to Machine Tools," by R. F. Runge; and "Anti-Friction Bearings in Ordnance Work," by Frank Braner.

Citroen at Capacity

In spite of the depression which is prevailing in France in the automotive industry as a whole, the Citroen company is said to be operating at full capacity, states a report to the Department of Commerce. The present daily production exceeds that of the best previous record of 400 cars. Furthermore, the 10 hp. model, which is now being offered more completely and luxuriously equipped than ever before, is meeting with increased favor. A cheap, six-cylinder model is to be exhibited at the next Paris automobile show, it is announced.

Aircraft Welding to Be Described at Coming Detroit Meeting

A session devoted to the application of welding in building aircraft will be one of the features of the annual fall meeting of the American Welding Society, to be held in the Book-Cadillac Hotel, Detroit, during the week of Sept. 19. At the same time there will be a welding and cutting exposition under the auspices of the society and in cooperation with the National Steel and Machine Tool exposition.

At the first technical session two papers will be presented: "Airplane Welding," by J. B. Johnson, of the Air Corps, McCook Field; and "Welding on the Long-Distance Aircraft," by a repsentative from the Atlantic Aircraft Corporation.

Other technical sessions, will follow, varied now and again by inspection tours to various industrial plants at Detroit. Some of the papers announced in the tentative program are: "Heat-Treatment by the Oxy-Acetylene Flame," by E. E. Thum; "A Metallurgical Study of Welds," by G. R. Brophy; "Car Welding," by Victor Willoughby; "Automobile Welding," by W. C. Harp; "Production Welding of Water Heaters," by H. J. Grow; "Welding in the Plant of the Combustion Engineering Corporation," by C. S. Reed; "Welding of Structural Steel," by Joseph Matte, Jr.; and "Welding in the Design of Steel Plate Work," by L. J. Sforzini.

France Proposes Added Funds for Aircraft

In the French budget proposals for 1928 the aeronautical division of the Ministry of Commerce has requested that appropriations for the development of French civil aviation be increased from 170,000,000 francs (the 1927 total) to 195,000,000 francs in 1928.

The principal increases requested are as follows: For subsidies to operating companies, 91,000,000 francs as compared to 78,500,000 during 1927; for installations in connection with technical and industrial aeronautical development, 6,000,000 francs instead of 3,130,000 francs in 1927. Five million francs are also requested for research equipment.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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ACCORDING to the latest trade directory there are 2,001 daily newspapers in the United States, and it is almost certain that each of them has published an editorial upon the unexpected announcement that President Coolidge issued last Monday. Any discussion of its political importance is therefore superfluous.

Those who are familiar with the idioms of New England speech insist that "I do not choose" means "I do not intend," and upon this exposition of the President's cryptic statement most people take it for granted that he will not succeed himself. This was the view taken on the Stock Exchange at the opening on Tuesday morning, and while the initial decline was arrested by *force majeur*, it is difficult to believe that what has been known as the "Coolidge Boom" will continue with its former vigor now that the end of the Coolidge administration has been predetermined by Mr. Coolidge himself.

But, as is quite natural, there are many who dissent from this view, and an immediate change in the price trend is not to be expected.

Various estimates of the number who are in this position are current. These estimates must all be guesswork, but the American Telephone and Telegraph Co. now has 422,000 stockholders, and as the habit of buying stocks and bonds has sprung up very rapidly in the United States, it is probable that there are at least a million persons in this country and Canada who own securities that were bought for resale at an advance and are not fully paid for. These people are scattered from Nova Scotia to Texas, and from Sandy Hook to the Golden Gate. It is unlikely that they will all change their opinions suddenly or at once.

Numerous defections from the bull ranks are therefore to be expected from time to time, and while those who are heavily committed to the cause of high prices will insist that there is no "inherent change in the situation," it is plain that the psychology of the market is in process of transformation, and that the average speculator is now more concerned about getting out than about getting in.

But it is equally plain that the decline will be slow and that it will be punctuated with frequent reactions. The continued cheapness of money guarantees this and the action of the Federal Reserve Bank of New York in reducing its rediscount rate to 3½ per cent indicates that those who ought to be well informed do not anticipate higher rates this autumn. This abundance of credit is, of course, the back log of speculation, but its influence is to some extent offset by the fact that brokers loans are now the highest on record, and that any further increase will be looked upon with apprehension.

In the foregoing, the stock market has been dealt with at unusual length because the interest in it is so widespread that general business is to some extent affected by its tone.

It is too early to say whether the President's announcement will have any effect upon distributive trade, but the recessionary tendency noted last week is still in evidence. Car loadings for the week ending July 23 show a decline of 6½ per cent as compared with last year, and railway net earnings for June are about 16 per cent under 1926.

Most of the chain store systems report a gain in sales, but jobbers say that it is at the expense of the independents and the old "general stores."

The demand for cotton and woolen goods has been fair. Raw wool is higher, but cotton futures have been fluctuating somewhat widely, on various crop estimates which have led speculators to fear that the next government report will be bearish. On the decline, which put the October position under 17 cents, some spinners have been buying, and with the most critical period of the growing season still ahead it seems unwise to expect much lower prices, at least for the present. The grain markets have not changed much and the shortage in the crops of wheat and corn appears to have been discounted for the present. Coffee has been steadier upon reports that fresh funds for the "defense" of that commodity have been made available. A permanent advance is, however, unlikely as the supply is admittedly in excess of demand. Sugar has relapsed into dullness, but its statistical position continues to gain strength and many well informed merchants are very confident of an advance in the belief that next year's Cuban crop will be restricted to 4,000,000 tons. Rubber is higher on the issuance of a bullish statement by a prominent American manufacturer of tires, and the announcement that British restrictions upon exports would be continued for the three months ending October 31. A further improvement in the demand for steel is reported, but it is slight. Copper has surprised the trade by its strength. The automobile business still waits on Ford.

On the whole the country is prosperous and complacent, and its complacency explains its reluctance to face the changes that the President's announcement implies.

WHAT'S DOING IN INDUSTRY

SOME encouraging trends have developed in the machinery and machine tool industry in the past week. In more than one important industrial center there has been a slight increase in activity. Orders, while still small in size, nevertheless make an imposing volume when considered in total. Inquiries are not crowding the market, but they do appear to be more genuine and bring orders quicker than heretofore.

NEW YORK has put off its air of depression, for the receipt of some good business, notably a half-million dollar export order, has served to brighten the outlook. The South is still marking time on orders, but inquiries promise some good fall business. Increased buying activity on the part of agricultural machinery, automotive and power plant equipment manufacturers in Canada foretells increased sales. New England reports progress with automotive business leading the way.

CINCINNATI reports a slight betterment in sales and inquiries. Detroit is still apathetic, but hopeful of early purchasing by automobile manufacturers. Inquiries are light and orders small in Chicago. A boom in inquiries from general industrial users of tools features the market around Indianapolis.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CINCINNATI

The majority of machine tool manufacturers in the Cincinnati district report a slightly-upward market trend in the past week. None report a falling off in orders, and therefore, taking the trade as a whole, a gain was made over the previous week. Selling agents report that in the week they did a little better than hold their own. Business conditions are regarded as being better than at this time last year, and there is no apprehension as to the future demand.

The feature of the past week's business was orders for single tools and replacements, but here and there was an order for two or three tools. The purchases were made by various users, located in all sections of the country. Several small export orders were received, including some from Russia and some from South America.

A good volume of domestic inquiries came in, considering the season, and as there were also a number from foreign countries, including South America, prospects are regarded as satisfactory.

Orders now booked and those that have been tentatively closed, it is stated, will maintain manufacture at its present level through the summer, and there is no thought of material curtailment of production.

DETROIT

Dullness still prevails in the machinery market in Detroit. A few scattered orders have been received, but in general the apathy of the past three weeks is unrelieved. Inquiries are coming in and a few of the dealers believe that this portends better things in the immediate future.

One dealer reports that he has received a fair sized order from the Ford Motor Co. and that a number of other large automobile manufacturers are contemplating purchases of special equipment. A few of the motor car companies are laying their plans for the fall and this gives rise to a certain optimism among the machinery dealers. The representative of a large belting manufacturer reports a few sales but nothing of any great importance.

The period of dullness here seems to be showing no signs of immediate breaking, although machinery men and tool shop owners believe the fall will be one of the best the industry has known in recent years.

NEW YORK

Increased activity in many lines marked the trend of the machinery and machine tool market in this territory in the past week. Several of the larger dealers report the receipt of some business that will put the month's total far ahead of July. The majority of dealers and agents report a more satisfactory tone in general industrial conditions hereabouts, and the number and character of current inquiries points to the placing of some substantial orders in the early fall. This does not mean that inquiries are numerous but that the type of tools in demand, and the nature of their intended use leads the trade to believe that a better season is in store after the summer months give way to fall manufacturing activity.

It is generally agreed that most present demand is for special tools intended to replace obsolete equipment. A great variety of users are represented among buyers, indicating a constantly increasing interest in automatic time- and labor-saving tools in the various branches of the metal working field. Considerable interest centers in the awarding of the contracts for machine equipment for the Argentine Naval Commission, bids for which were submitted on Aug. 1. Some other attractive export business is in sight.

The Niles-Bement-Pond Co. has received an order for machine shop equipment for the central repair shop of the Sorocobana Ry., in Brazil. The order totals over a half million dollars and is said to be the largest single order for machine tools placed in the United States since 1921. These shops, located at Sorocobo, in the state of São Paulo, will be the most modern in all of South America.

CHICAGO

Business conditions in the machine tool industry show no change from those last reported. A state of comparative lethargy may be said to exist so far as buying and selling is concerned. Inquiries are light, and for the most part contemplate only single tools or small lots. While demand cannot be said to be without some encouraging features, it shows only in spots.

An exception to the rule is seen in the activity found in plants manufacturing gears and speed reducers. These are working to capacity to meet the demand for their specialties. The first half of 1927 is reported by one of the largest plants of this kind to be far ahead of 1926 in the volume of business recorded.

There is a little desultory buying on the part of the railroads, but this has almost reached the vanishing point so far as old lists are concerned. The Rock Island is reported to be in the market for grinders, but with this exception railroad inquiries are negligible. The Chicago Board of Education is reported to be on the point of issuing a list of tools needed for the Lane Technical High School. Used tools are in light demand.

INDIANAPOLIS

If inquiries were orders business would be exceptionally good in the machinery and machine tool trade here. Even though inquiries do not ring the cash register, the trade is viewing the volume rather optimistically and believes that August will see a decided turn in the business trend. As it is, actual sales are spotty, with no large orders. Every bit of buying done, it would seem, is for emergency replacements.

Perhaps the worst markets at the present time are the automobile industry and the railroads. Virtually none of the automobile plants are buying. Drastic economies of the railroads operating in Indiana, coupled with lack of business, due largely to the coal strike, has cut off this source of demand. Repair programs of the railroads have been reduced.

A fair demand continues for contractors' equipment, however. Concrete mixers, cranes, hoists and other such equipment is selling well, though hardly in the same volume as last year. Some demand continues also from garages for small lathes, automatic valve grinding machines and drills, but another month of this business is expected to see a slump in the demand.

Demand also is slow in the lumber machinery business, orders from Southern and West coast mills having fallen off, though a fair demand is reported for woodworking machinery from the furniture factories. Inquiries continue to be received from many sources, however, with the farm implement factories apparently anxious concerning equipment.

CANADA

A feature of the metal working situation in Canada at present is the great activity which is being experienced in the agricultural machinery industry. Two huge shipments of threshing machines left eastern Canada recently for points in the West. One shipment, comprising 106 machines, was from the works of the International Harvester Co., at Hamilton; while the other was made up of 120 McCormick-Deering threshers. Further important orders have been placed for other types of agricultural machinery and equipment in expectation of a bumper crop this year.

The Huntley Manufacturing Co., of Tillsonburg, Ontario, manufacturing milling machines, reports having secured an order from western Canada of such magnitude as to keep the plant running at full capacity during the remainder of the year.

Machine tool manufacturers report a fair volume of business during July. The machine tool requirements of a new paper mill in Quebec were placed recently. There is a big demand for power equipment. The Canadian General Electric Co. reports that sales are running 20 per cent above the total of business of 1926. The Turbine Equipment Co. of Toronto, recently received orders for two 8-in. centrifugal pumps for Midland, Ontario. The Consolidated Mining and Smelting Co., of Canada, has decided to double the power of its plant at Kimberley, involving the purchase of four steam boilers and two turbines.

Automobile production continues to register increases. For the six months ending June the output was 126,808 cars, having a sales value, f.o.b. plant, of $80,943,907, a gain of 2 per cent in number and 7 per cent in value over the corresponding period of last year.

The iron and steel industry is moderately active under conditions of keen competition and close selling. During the last week of July the fence, wire and nail mills of the Dominion Steel Corporation started up after having been idle for several weeks.

SOUTHERN DISTRICT

Dealers state that while machinery and tool sales in the Southeast have shown scarcely any improvement in the last two or three weeks, inquiries are picking up and indications give promise of a better business during the late summer and fall than was enjoyed at that period last year. The high crop prices prevailing in the Southeast, especially cotton, give business men a better feeling over the future, and this confidence is reflected in the machinery and other markets.

There are still some good sales being

made to the furniture and lumber industries in the woodworking equipment line, though volume is less than it was three or four weeks ago, most of the present orders being of comparatively small size. The textile industry also continues to place some fairly good orders, mainly for installation in new plants or additional mill units being constructed, and indications are that this business will hold up satisfactorily for the next month or so. A few sales are being reported in the railroad field for heavier shop equipment.

In the used and rebuilt equipment line service stations and garages in the Southeast are placing a few orders, most of them small, but few sales are reported to smaller machine shops. Neither of these fields is buying much new equipment.

Contractors' equipment is showing a tendency to pick up as building is assuming signs of greater activity, and the outlook in this field is considered good for late summer and fall.

NEW ENGLAND

One of the interesting developments of the week in the machinery industry of New England was the announcement by the Fafnir Bearing Co., of the production of a new article of manufacture—a ball bearing shackle bolt for automobiles. Business is expected in substantial volume from the automotive industry. In fact, at the company's office in New Britain, Conn., it was stated that a few substantial orders were already booked.

Production machinery orders were numerous in the business placed during the past week. The special machinery trade is excellent. Small tool sales slowed up slightly.

The automotive trade gave the principal part of the business placed. Buying by railroads is expanding. Buying for export delivery shows further improvement.

Industry Wants Men and Facts—Not Data

Speaking on the relation of the automotive industry to the university, at a meeting of the Indiana section of the Society of Automotive Engineers held at Purdue University, J. H. Hunt, of the Chevrolet Motor Co. and president of the society, said that two things the industry wants of the university are men and facts. The men needed must be trained to analyze and to think independently.

The first function of the university is to train men to think, he said, because how they think is of immensely greater importance than what they are thinking about, as it is very difficult to change a man's way of thinking after the years he has spent in college. They must be trained to be students in such an industry as the automotive industry, as it is necessary for men working in this field to adapt themselves to changed situations. This study does not take the form of reading text books, however.

To be successful in the industry, the young men must be teachers as well as students. Mr. Hunt referred to a survey made recently by the American Management Association of the disposition of executives' time which showed that 90 per cent of the time of an executive is spent in educating the men under him.

The facts that are wanted are fundamentals. It is vastly more important that boys leaving a university shall know the fundamental facts of physics and chemistry than the latest methods used in some engineering laboratories to solve a specific problem. Many young men after leaving college begin collecting data, but unfortunately do not know enough about what they are seeking to accomplish. They would be better off if they took fewer data and analyzed these so that they could carry the main fundamental relations entirely in their heads. This would be more useful to them than an encyclopedia full of tests of every automotive engine produced in America.

Slight Drop in Railway Operating Income

Class I Railroads for the first six months this year, had a net railway operating income of $472,611,052 which was at the annual rate of return of 4.58 per cent on their property investment, according to reports just filled with the Bureau of Railway Economics. In the first half of 1926, their net railway operating income was $495,598,414 or 4.93 per cent on their property investment.

Property investment is the value of road and equipment as shown by the books of the railways, including materials, supplies and cash. The net railway operating income is what is left after the payment of operating expenses, taxes and equipment rentals, but before interest and other fixed charges are paid.

This compilation as to earnings for the first half of 1927 is based on reports from 183 Class I railrorads representing a total mileage of 238,269 miles.

In view of the fact that railway business and earnings fluctuate from year to year, only the showing of results over a period of years can indicate the real trend of railway returns. The rate of return on property investment for the five years ending with the month of June, 1927, has averaged 4.55 per cent.

Education Takes Fourth of Public Funds

More than two billions dollars, or more than one-fourth of the total net of all public expenditures in the United States during the year 1925, were spent on education as given in the public schools and in state universities, according to the National Industrial Conference Board. Education, in fact, absorbs a greater proportion of public funds than does any other governmental function, more even than all our military, police, fire protection and prohibition enforcement expenditures combined.

The "true" cost of education in our public school system in 1925 was 69.4 per cent, or more than two-thirds greater than it was in 1890 per pupil for each school day actually attended. With the price factor and the increase in population and school enrollment accounted for, this 69.4 per cent increase in expenditures per pupil represents the real cost of whatever progress we have achieved in education efficiency during the 35-year period. It is an increase averaging less than 2 per cent per annum, which in the light of the board's study is to be considered as "not excessive."

Georgia Manufacturers Seek Tax Reduction

Robert Gregg, president of the Atlantic Steel Co., Atlanta, and Bryan Blackburn, of the R. D. Cole Manufacturing Co., Newnan, Ga., foundry and machine shop operators, were re-elected vice-presidents of the Georgia Manufacturers' Association at the twelfth annual convention held recently at Savannah, Ga. Horace Lanier, president of the West Point Iron Works, West Point, Ga.; John S. Schofield, president of J. S. Schofield & Sons Co., Macon, Ga., machinery manufacturers, and T. E. Golden, president of the Golden Machine and Foundry Co., Columbus, Ga., were re-elected to the board of directors. The association adopted resolutions recommending a reduction in the Federal corporation income tax and the repeal of the inheritance tax.

Aeronautical Notes

The Boeing Airplane Co. has taken over from the Post Office Department the operation of the Western division of the transcontinental air mail service between Chicago and San Francisco, it was announced on June 30 by Postmaster General New. The Post Office Department will continue to operate the Eastern division between Chicago and New York for one month when it will be turned over to the National Air Transport, Inc.

Two Junkers transports equipped with 185-hp., B.M.W. engines with a carrying capacity of 4 passengers plus a pilot and a mechanic, have arrived in Buenos Aires from Germany and have been delivered to the Ministry of War, according to advices received by the Department of Commerce. These machines are similar to the ones at present employed in the Montevideo and Cordoba air transport services and will be used by the Ministry for carrying out inspection trips to different parts of the Republic.

The Aktiebolaget Flygindustri at Malmo is reported as operating at capacity with enough orders on hand to keep the plant busy for six months, according to advices received by the Department of Commerce.

This firm is now advertising extensively and the results seem very satisfactory. It is reported that the Turkish government has invited one of this firm's pilots to visit Turkey and he is now in that country to demonstrate planes. Another pilot recently left Malmo in a large three-motored bombing plane of the G. 23 L type and is now in Italy at the request of the Italian government to demonstrate this plane.

Personals

F. A. MOSLEY, of Montreal, Canadian manager for the Austin Manufacturing Co. of Chicago, has resigned in order to join the sales staff of the Sawyer-Massey Co., Ltd., Hamilton, Ontario.

A. J. NESBITT and JAMES B. WOODYATT, president and vice-president respectively of the Power Corporation of Canada, have returned to Montreal from a trip to France in connection with the Foreign Power Securities Corporation, Ltd.

JOHN F. KENT, formerly general manager of the American Cast Iron Pipe Co., Birmingham, Ala., has been appointed general manager of the Birmingham Galvanizing Co., Inc., a new concern recently organized at Birmingham, and now establishing a large galvanized pipe plant at that city.

WALLACE J. HORNELL has joined the Toronto, Canada, staff of the Arthur Jackson Machine Tool Co., and will specialize in portable electrical equipment and toolroom supplies. Mr. Hornell served his apprenticeship in the machine shops of the Canadian National Railways, and was also tool maker for the firm of A. Schrader & Sons, Toronto.

Business Items

The Chicago office of the Climax Engineering Co. has been removed to Room 1608 Harris Trust Bldg., 111 West Monroe St. F. E. Blanchard is in charge of this branch.

Installation of machinery in the new forge plant of the Ames Shovel and Tool Co., Anderson, Ind., is nearly completed. Officials expect to have the new plant in operation in ten days.

The New England Wire Machinery Co. of New Haven, Conn., announces the change in its name to the Wire Machinery Corporation of America, Inc. The personnel of the organization will be retained as heretofore.

The Hughes Tool Co., 300 Hughes St., Houston, Tex., distributors of machine tools and mill supplies in the Southwestern district, has announced the awarding of contracts for the construction of a new warehouse.

The Peelle Co., Brooklyn, N. Y., manufacturer of safety appliances, fire doors, etc., announces the recent opening of a new Southeastern branch in Atlanta at 301 Norris Bldg. Charles E. Wilcock is in charge as district manager.

The Carroll & Jamieson Machine Tool Co., of Batavia, Ohio, has purchased the patterns and tools formerly used in the manufacture of the I. H. Johnson engine lathe, and will henceforth be able to supply repair parts for those machines.

The H. E. Shelton Machinery Co., Paducah, Ky., has been organized and incorporated to distribute machinery and equipment in the central and Southern territory. Incorporators include Howard E. Shelton, 1120 Jefferson St., Paducah; L. R. Barnes and others.

The R. G. Haskins Co., of Chicago, manufacturer of flexible steel shafting, has bought the property located at 4630-36 Fulton St., from the Regan Construction Co., on which a new building is being erected. The purchasers will use the building for plant and offices.

The Thorpe Textile Service has been organized and incorporated at Gastonia, N. C., for the manufacture of textile machinery parts and the repair and upkeep of textile mill equipment, it has been announced by Arthur Thorpe, of Gastonia, general manager of the company.

The General Airways Corporation, of New York, has purchased the plants at Canestota, N. Y., formerly occupied by the Sherwood Bros., and by the Marvin Casler Co. The manufacture of the new Hartney airplane and the Century motor will begin as soon as the alteration and equipment of the plants is completed.

The Canada Machinery Corporation, of Galt, Ontario, has opened an office in Montreal, at 405 Power Bldg., 43 Craig St. A. W. Irving, formerly manager of the Toronto office, will be in charge. Associated with him will be J. H. Langis, who has been connected with the wood-working machinery business in Quebec.

The J. L. Latture Equipment Co. of Portland, Oregon, representatives in Oregon, Washington and Idaho, of the Climax Engineering Co., are now located at 312 E. Madison St., Portland. The new location will house both offices and warehouse. A line of Climax engines, power units, and replacements parts are carried in stock.

The erection of two additional plants announced by General Motors of Canada brings the total building program of the company for the year 1917 to nearly $2,000,000. A paint shop will be constructed at a cost of $200,000, and an addition to the body plant will also be erected at an approximate cost of $200,000.

The machine shop of the Hilles & Jones Co., machinery manufacturers and a division of the Consolidated Machine Tool Corporation of America, will be moved from Wilmington, Del., to Rochester, N. Y., where it will become part of the main plant of the Consolidated organization. It is stated that the plant will resume operations at some future date. The foundry will remain at Wilmington.

Sprout, Waldron & Co., of Muncy, Pa., have taken over all the patterns, equipment, etc. of the Valley Iron Works, of Williamsport, Pa., and will now handle all Monarch transmission appliances, including a complete line of milling machinery equipped with Westinghouse motors and controllers. A new machine shop and stockroom has been built and equipped. The foundry has been enlarged to double the former capacity and special machinery has been installed. Stocks of all sizes of standard bearings, couplings, collars, takeups, etc., will be maintained for immediate shipment.

Announcement is made of the consolidation of the alternating current patents known as the Holslag patents, controlled by the Electric Arc Cutting and Welding Co., of Newark, N. J., with the inductive reactor a.c. patents, known as the Arendt patents, controlled by the Owen Electric Manufacturing Co. License for the use of either patents will be granted. The following companies are agreed in the consolidation: Electric Arc and Welding Co., Owen Electric Manufacturing Co., Gibb Welding Machines Co., Allen Manufacturing and Welding Co., Seneca Electric Arc Welder Co., Siemund-Seneca Corporation, Welding Service, Inc., and the Weldrite Co.

Obituaries

JOHN GOWANS KENT, general manager of the Canadian National Exhibition, died at his home in Toronto, Ontario, on July 28. Mr. Kent was associated with a number of enterprises in Toronto, and for many years took a deep interest in the industrial problems of the Dominion.

ARTHUR BUELL ARMSTRONG of Kokomo, Ind., director and general manager of the Superior Machine and Tool Co., the Kokomo Nail and Brad Co. and the Kokomo Spring Co., died recently at his home. He was one of the organizers of a big wholesale hardware store years ago, the owner of a wholesale candy business, owner and manager of a hotel and president of a national bank in Kokomo. In addition he was a director in many other business and manufacturing institutions.

Autos Replaced in 1926

Two out of every five cars, or almost 40 per cent of world production, were used to replace old automobiles in 1926, according to the automotive division of the Department of Commerce.

World production in 1926 approximated 5,091,474 automobiles, including passenger cars, buses, and trucks; however, the number of vehicles in use increased only 3,061,018, therefore 2,030,456 cars, or 40 per cent of world production, replaced cars worn out or retired from service. Sales of automobiles in the United States for replacement totaled 1,850,838, or 47 per cent.

Forthcoming Meetings

Steel and Power Show. First Steel and Power Show in the Varsity Arena, Toronto, Canada, sponsored by the Montreal and Toronto Chapters of the American Society for Steel Treating; by the Canada, Toronto and Hamilton Councils of the Universal Craftsmen's Council of Engineers; by the Engineers' Mutual Benefit Fund; the American Electroplaters' Society; and the Canadian section of the American Welding Society. Aug. 31 to Sept. 2. General chairman, C. Bradshaw, 153 University Ave., Toronto, Canada.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Society of Automotive Engineers. Production Meeting, starting at Hotel Winton, Cleveland, Sept. 19 and 20; continuing at Hotel Statler, Detroit, Sept. 21 and 22. C. E. Heywood, manager of meetings, 29 West 39th St., New York City.

American Welding Society. Fall meeting, Book-Cadillac Hotel, Detroit, Sept. 19 to 23. M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals. Sectional meeting, Hotel Statler, Detroit, Sept. 19 to 23. H. Foster Bain, general secretary, 29 West 39th St., New York City.

National Steel and Machine Tool Exposition. Under the auspices of the American Society for Steel Treating. Convention Hall, Detroit, Sept. 19 to 23. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Machine Tool Builders' Exposition. First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, Pennsylvania Bldg., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Building, Cincinnati, Ohio.

American Institute of Steel Construction. Annual convention at Pinehurst, North Carolina, Oct. 25 to 29. Charles F. Abbott, executive director, 285 Madison Ave., New York City.

National Association of Manufacturers. Annual convention, Read House, Chattanooga, Tenn., Oct. 25, 26 and 27. George S. Doudinot, secretary, 50 Church St., New York City.

National Exposition of Power and Mechanical Engineering. Sixth annual event in the Grand Central Palace, New York, Dec. 5 to 10. Charles F. Roth, manager, Grand Central Palace, New York City.

The Weekly Price Guide

Rise and Fall of the Market

FURTHER improvement is noted in the market for non-ferrous metals, with upward tendency in prices. Fabricated brass and copper and scrap, particularly in the Mid-West, reflect the upward turn in the raw metals. Demand for steel bars remains active; rivets are higher this week at Pittsburgh mills. The principal hot-rolled steel products hold to the $1.80 per 100 lb. level, f.o.b., Pittsburgh. Galvanized sheets are in better demand, while black sheets declined during the week at Cleveland. Light buying is noted in automotive and railway material and steel scrap. Pig-iron prices declined again this week, reaching levels below those of five years ago; c.-i. pipe is also down, with quotations close to those obtaining in 1916.

(All prices as of Aug. 5)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	17.75
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.25	3.50	3.25	3.89
No. 12	2.30	3.55	3.30	3.94
No. 14	2.35	3.60	3.35	3.99
No. 16	2.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.80	3.75	3.55	4.00
No. 22	2.95	3.90	3.70	4.15
No. 24	3.00	3.95	3.75	4.20
No. 26	3.10	4.05	3.85	4.30
No. 28	3.25	4.20	4.00	4.45
Galvanized				
No. 10	3.15	4.10	3.95	4.25
Nos. 12 to 14	3.25	4.20	4.05	4.35
No. 16	3.35	4.30	4.15	4.45
No. 18	3.50	4.45	4.30	4.60
No. 20	3.65	4.60	4.45	4.75
No. 22	3.70	4.65	4.50	4.80
No. 24	3.85	4.80	4.65	4.95
No. 26	4.05	5.05	4.90	5.20
No. 28	4.30	5.30	5.15	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.65	3.60
Cold drawn flats, squares	4.50	4.15	4.10
Structural shapes (base)	3.34	3.00	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.65	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛", 8.35c.; ¼", 7.85c.; 5/32" to ½", 7.35c. per lb. *Flat, ⅛"@½-in. thick.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			14.62½
Tin, pigs, 5-ton lots, New York			67.12½
Lead, pigs, up to carlots, E. St. Louis 6.55		New York	7.37½
Zinc, slabs, up to carlots, E. St. Louis 6.42½		New York	7.37½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	15.00	17.50	13.00
Copper sheets, base	21.75	22.00	21.75
Copper wire, base	18.50	18.75	15.00*
Copper bars, base	21.25	21.50	21.25
Copper tubing, base	23.75	24.62½	23.75
Brass sheets, high, base	18.00	18.25	18.00
Brass tubing, high, base	22.87½	23.12½	22.87½
Brass rods, high, base	15.75	16.00	15.75
Brass wire, high, base	18.50	18.75	18.50

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	11.00	11.55	10.11
Solder (½ and ½), (case lots)	39.00	40.50	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			82.00
Commercial genuine, intermediate grade			61.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			13.00
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00	Electrolytic 39.00	Shot 36.00	

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.37½@11.62½	10.75	9.75@10.25
Copper, heavy, and wire	10.62½@11.12½	10.75	9.00@ 9.50
Copper, light, and bottoms	9 37½@ 9.87½	9.25	8.00@ 8.50
Heavy lead	5.25 @ 5.50	5.75	4.50@ 4.75
Tea lead	4.25 @ 4.50	3.75	3.00@ 3.50
Brass, heavy, yellow	7.25 @ 7.50	7.00	6.25@ 6.75
Brass, heavy, red	8.50 @ 9.00	9.50	8.50@ 9.00
Brass, light	5.00 @ 5.50	6.00	5.50@ 6.00
No. 1 yellow rod turnings	7.25 @ 7.75	7.00	6.50@ 7.00
Zinc	3.75 @ 4.00	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.15½	36.00 per M	.15
Sal soda, per lb	03¾	.02	.02¾
Roll sulphur, per lb	.027	03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	84	.91	.83½
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	65	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	27	35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	30–10–5%
Heavy grade	30–10%	30–10%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.1575	.1525	.1687½
Solder (½ and ½)	per lb.	.39	.40	.41
Cotton waste, white	per lb.	.10@13½	10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	65	.65	.55
Machine oil	per gal.	27	33	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton, Connellsville			3.00@3.25
Coke, prompt foundry, per net ton, Connellsville			4.25@4.75
White lead, dry or in oil,	100 lb. kegs	New York,	13.75
Red lead, dry,	100 lb. kegs	New York,	13.75
Red lead, in oil,	100 lb. kegs	New York,	15.25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Broken Kegs or Cases	Full Kegs or Cases
Machine bolts, square heads and nuts:		
Up to ¾ x 6-in.	50%	50–10%
Larger up to 1 x 30-in.	45%	50%
1¼ and 1½ in. dia.	30%	35%
Carriage bolts:		
Up to ½ x 6-in.	50–10%	.....
Larger sizes	50%	.....
Coach and lag screws:		
Up to ½ x 6-in.	50–10%	.....
Larger sizes	50%	.....
Tap bolts, hexagonal heads	45%	.....
Nuts:		
Hot pressed, square and hexagonal, blank or tapped	45%	50–10%
Cold punched, square and hexagonal, blank or tapped	45%	50–10%
Semi-finished, hexagonal, tapped, in packages	40%	.....
Case hardened, hexagonal, tapped, in packages	30%	.....
Washers: Deduct from list, per 100 lb.	$1.50	$3.50
Rivets, button and cone head:		
Small, including 7/16-in. dia.	.....	50–10%
Large (base) per 100 lb.	$6.50	$5.00

EXTRA per 100 lb. on rivets: For ¼-in. dia., 35c.; ⅜-in., 15c.; 1-in., 5c.; length 1-in. and shorter, 25c.; longer than 1-in. up to and including 1½-in., 15c.; longer than 5-in., 25c.; standard countersunk head, 25c.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Jamaica Plain (Boston P. O.)—H. Bettoney, 106 Chestnut St.—Brown-Sharp hand screw machines, No. 1 and 4, and Burke sensitive drill, No. 1 or similar.

Mo., Nevada—W. F. Norman Sheet Metal Mfg. Co.—power presses.

O., London—Clelland & Mouser, Second and Oak Sts., W. Clelland, Purch. Agt.—equipment including small lathe, drill press, etc. for new service station.

O., London—London Knight Motor Sales Co., 24 East High St., J. O. Cummins, Purch. Agt.—wheel puller, valve grinder, etc. for proposed new service station.

O., New Lexington — White Motor Co., Brown & Jackson Sts., H. White, Pres.—drill press, reamer, air compressor and other equipment for proposed new service station.

Ont., Penetanguishene — T. J. Payette — prices and catalogs on general equipment for the manufacture of oil burners for plant. Estimated to cost $50,000.

Que., Montreal — M. Baronafsky, 385 Ioques St.—complete equipment for blacksmith shop.

Que., Montreal—M. Vineberg Investment Corp., 591 St Catherine St. W.—complete equipment for proposed garage and repair shop.

Opportunities for Future Business

Ala., Birmingham — Fairbanks-Morse & Co., 311 North 23rd St., awarded contract for the construction of a new 2 story plant at Smith Park.

Ark., El Dorado—Griffin Bros., will soon receive new bids for the construction of a 1 story, 80 x 400 ft. garage. Estimated cost $140,000. C. L. Thompson, Home Insurance Bldg., Little Rock, Archt. Former bids rejected.

Calif., Alhambra—Reliance Mfg. Co., Pasadena, awarded contract for the construction of a 1 story, 115 x 180 ft. foundry and 1 story, 60 x 280 ft. machine shop on Meridian Ave. here. Estimated cost $150,000. Noted July 28.

Calif., Oakland—E. C. Anthony Co., 2111 Webster St., awarded contract for the construction of a 2 story garage on Harrison St. Estimated cost $150,000.

Conn., Bridgeport—E. A. Lambert, 542 Fairfield Ave., will receive bids until Aug. 15 for the construction of a 1 and 2 story, 100 x 240 ft. garage. F. Thompson Inc., 542 Fairfield Ave., Archt. Noted Apr. 28.

Conn., Hartford—Owner, c/o R. J. Farrell, 10 Irving St., awarded contract for the construction of a 1 story service station on Farmington Ave. Estimated cost $60,00.

Conn., New Haven—Connecticut Co., J. K. Punderford, Pres., 236 Church St., awarded contract for the construction of a 1 story, 35 x 200 ft. garage on Grand Ave. Estimated cost $45,000.

Ill., Chicago—E. Holt Co., 6826 South Chicago Ave., manufacturers of automobile bumpers, etc., awarded contract for the construction of a 1 story, 150 x 150 ft. factory at 69th St.and South Chicago Ave. Estimated cost $50,000.

Ill., Chicago—Ramp Building Corp., 21 East 40th St., New York, N. Y., awarded contract for the construction of a 10 story, 100 x 124 ft. garage at 318-328 Federal St. here. Noted June 2.

Ill., Chicago—Syndicate, c/o H. F. Knipp, 4802 Broadway, awarded contract for the construction of a 2 story, 180 x 250 ft. garage, etc. at 3531 to 3551 Broadway. Estimated cost $1,115,000.

Ind., Anderson—Maring Wire Co., Muskegon, Mich., awarded contract for the construction of first unit of plant here. Estimated cost $50,000. Noted June 23.

La., Southport—Hannibal Car Wheel & Foundry Co., Hannibal, Mo., awarded contract for the construction of a 38 x 38 ft. foundry, 200 x 200 ft. machine shop, etc. for car wheel plant here.

Mass., Boston—Meisel Press Mfg. Co., Dorchester Ave., is having revised plans prepared for the construction of a 1 and 2 story, 100 x 225 ft. plant H. S. Cleverdon, 46 Cornhill, Archt. and Engr. Former bids rejected. Noted July 14.

Mass., Cambridge (Boston P. O.)—W. G. Galgay, 718 Massachusetts Ave., awarded contract for the construction of a 3-story shop. Estimated cost $40,000.

Mass., Cambridge (Boston P. O.)—McSorly Bros. Broadway Garage, 456 Broadway, is having sketches made for the construction of a 1 story addition to repair and service garage. Estimated cost $45,000. H. M. Ramsey, 184 Boylston St., Boston, Archt.

Miss., Meridian—M. R. Adams, 2109 Fourth St., is having preliminary plans prepared for the construction of a 3 story, 100 x 275 ft. sales and service station at 4th to 5th Sts. and 17th to 18th Aves. Estimated cost $150,000. Private plans.

Mo., St. Louis—Messmer Brass Co., 2700 South Seventh Blvd., awarded contract for the construction of a 2 story, 28 x 72 ft. addition to foundry. Estimated cost $25,000.

N. J., Newark—General Lead Batteries Co., 4 Lister Ave., awarded contract for the construction of a 1 story, 90 x 375 ft. factory on Chapel St. Estimated cost $50,000.

N. J., Newark—Hygienic Tube Co., 88 McWhorter St., will build a 1 story, 55 x 123 ft. factory at Ave. L. and Niagara St. Estimated cost $40,000. A. Peter, 207 Market St., Archt.

N. Y., Syracuse—The White Motor Co., c/o H. R. Hadlow, Engr., 842 East 79th St., Cleveland, O., will receive bids until Aug. 9 for the construction of a 1 story sales and service station here. Estimated cost $150,000. Private plans. Noted July 7.

O., Alliance—E. H. Althouse, Salem, plans the construction of a 2 story, 94 x 120 ft. garage on East Columbia St. here. Estimated cost $50,000.

O., Cleveland—Modern Mfg. Co., W. F. Bach, Secy., 4734 Hough Ave., manufacturers of heaters, awarded contract for the construction of a 1 and 2 story, 120 x 165 ft. factory. Estimated cost $40,000.

O., Cleveland—N. Perry, c/o Goakes & Dettelbach, Williamson Bldg., awarded contract for the construction of a 2 story, 50 x 200 ft. sales and service station at 7224 Euclid Ave. Estimated cost $100,000.

O., Youngstown—Sharon Steel Hoop Co., plans extensions and improvements to rolling mill. Estimated cost $250,000.

Ore., Salem—P. Wallace will soon award contract for the construction of a 1 story, 200 x 200 ft. garage. Estimated cost $100,000. M. H. Whitehouse, Railway Exchange Bldg., Portland, Archt.

Pa., Franklin—The Chicago Pneumatic Tool Co., 572 West Randolph St., Chicago, Ill., will soon award contract for the construction of three factory buildings, 100 x 293, 130 x 220 and 60 x 330 ft., all 1 story here. E. McGeorge, 3030 Euclid Ave., Cleveland, O., Archt. and Engr. Noted July 7.

Pa., Johnstown—Penn Machine Co., Station St., awarded contract for the construction of a 2 story, 40 x 120 ft. factory. Estimated cost $40,000.

Pa., Philadelphia—Auto Club of Philadelphia, 23rd and Ludlow Sts., will soon award contract for the construction of a 2 story, 120 x 220 ft. addition to garage. Ballinger Co., 12th and Chestnut Sts., Archt.

Pa., Philadelphia—General Baking Co., Broad and Butler Sts., will receive bids until Aug. 22 for the construction of a 1 story, 61 x 191 ft. garage, etc. at Godfrey St. and Rising Sun Ave. C. Bloomstock, 110 West 40th St., New York, N. Y., Archt.

R. I., Providence—Belcher & Loomis Co., 89 Wybst St., awarded contract for the construction of a 4 story, 112 x 220 ft. service building at West Exchange and Mason Sts.

R. I., Providence—J. Conn., 104 Broad St., is having plans prepared for the construction of a garage at Broad and Chestnut Sts. Estimated cost $150,000. T. J. H. Pierce, 275 Washington St.

Tenn., Chattanooga—Broad Street Co., c/o C. T. Jones, James Bldg., Archt., is having plans prepared for the construction of a 50 x 100 ft. garage. Estimated cost $150,000.

Tex., Marshall—Marshall Wood Products Co. and Linden Chair Works Co., plan the construction of two factory buildings and warehouse. Estimated cost $75,000. Private plans.

Tex., Presidio—Kansas City, Mexico & Orient Ry. Co., Wichita, Kan., has acquired a site and plans the construction of machine and repair shops, roundhouse, etc. here. Estimated cost $200,000. W. L. Churchill, Ch. Engr.

Va., Suffolk — Montgomery Lumber Co., G. B. Montgomery, 5 Nassau St., New York, N. Y., Pres., is considering plans for rebuilding mill recently destroyed by fire. Estimated cost $125,000.

W. Va., South Charleston — (Charleston P. O.)—Westvaco Chlorine Products Inc., A. M. Pitcher, Gen. Mgr., awarded contract for the construction of a group of buildings including machine, blacksmith, carpenter and pipe shops, etc.

Wis., Green Bay—Greenwood Rental Co., 315 Monroe St., awarded contract for the construction of a 1 story, 60 x 90 ft. service station.

Wis., Green Bay—G. & F. Schefe, 428 South Broadway awarded contract for the construction of a 2 story, 70 x 95 ft. repair shop and service station. Estimated cost $40,000.

Wis., Green Bay—Standard Oil Co., G. Webb, Dist. Mgr., awarded contract for the construction of a 1 story, 76 x 147 ft. machine shop. Estimated cost $40,000.

Wis., Milwaukee — Allen-Bradley, 286 Greenfield Ave., manufacturers of electric apparatus, will soon award contract for the construction of 9 story, 50 x 150 ft. plant at Greenfield Ave. and Reed St. F. Scott, 214 Mason St., Archt.

Wis., Milwaukee — North Side Building Co., awarded contract for the construction of a 3 story, 50 x 150 ft. garage at Third and Chambers Sts. Estimated cost $50,000.

Wis., Shawaro—Service Motor Co., c/o J. Popp, Prop., will build a 1 story, 40 x 68 ft. service station. Estimated cost $40,000. Private plans.

Wis., Wausau—Wisconsin Valley Electric Co., H. L. Gressl, Mgr., 206 3rd St., will build a 1 story, 96 x 185 ft. repair shop. Estimated cost $42,000. Oppenhamer & Obel, Archts.

B. C., Vancouver—J. Coughland & Sons, plans addition to steel fabricating plant. Noted Mar. 17.

Ont., Toronto—Bay & Adelaide Garage Ltd., c/o C. Dolphin, 10 Leader Lane, Archt., awarded contract for the construction of a 6 story garage at Bay and Adelaide Sts. Estimated cost $500,000.

Que., Montreal—Imperial Oil Ltd, 1000 St. Patrick St., plans the construction of additional service stations throughout Canada. Estimated cost $300,000.

Japan, Tokio — Nippon Electric Co., awarded contract for the construction of a 4 story, 60 x 250 ft. factory to H. K. Ferguson Co., 4900 Euclid Ave., Cleveland, O. Estimated cost $300,000.